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DREAMS:

THEIR PLACE IN THE GROWTH OF PRIMITIVE BELIEFS.

By EDWARD CLODD.

XII.

IN these times, when many run to and fro, and knowledge is increased, we forget how recent are the tremendous changes wrought by the science that—

> "Reaches forth her arms
> To feel from world to world, and charms
> Her secret from the latest moon."

Dulled by familiarity, we forget how operative these changes are upon opinions which have been—save now and again by voices speedily silenced—unquestioned during centuries. It is, in truth, another world to that in which our forefathers lived. Even in science itself the revolution wrought by discoveries within the last fifty years is enormous. Our old standard authorities, especially in astronomy and geology, are now of value only as historical indices to the progress of those sciences, while in the domain of life itself, the distinctions between plant and animal, assumed under the terms Botany and Zoology, are effaced and made one under the term Biology. Sir James Paget, in a profoundly interesting address on Science and Theology, has pointed out that it was once thought profane to speak of life as in any kind of relation or alliance with chemical affinities manifest in lifeless matter; now, the correlation of all the forces of matter is a doctrine which investigation more and more confirms. It was believed, many believe it still, that an impassable chasm separated the inorganic from the organic, the latter being attained only through operations of a vital force external to matter. That chasm was imaginary. Even the supposed difference between plants and animals in the existence in the latter of a stomach by which to digest and change nutritive substances, vanishes before the experiments on carnivorous plants. And not only do the observations of Mr. Darwin go far to show the existence of a nervous system in plants, but examination of crystals shows that a "truly elemental pathology must be studied in them after mechanical injuries or other disturbing forces." And is man, "the roof and crown of things," to witness to diversity amidst this unity?

If we hesitate to believe that our metaphysics have been evolved from savage philosophy, that our accepted opinions concerning man's nature and destiny are but the improved and purified speculations of the past, we must remember what long years had elapsed before the spirit of science arose and breathed its air of freedom on the human mind. The Christian religion wrought no change in the attitude of man towards the natural world; it remained as full of mystery and miracle to the pagan after his conversion as before it. When that religion was planted in foreign soil, it had, as the condition of its thriving, to be nourished by the alien juices. It had to take into itself what it found there, and it found very much in common. Although it displaced and degraded the *Dii majores* of other faiths, it had its own elaborated order of principalities and powers; it had as real a belief in demons and goblins as any pagan; and it was, therefore, simply a question of baptising and re-christening the ghost-world of heathendom, substituting angels for swan-maidens and elves, devils for demons, and retaining unchanged the army of evil agencies, who as witches and wraiths swarmed in the night and wrought havoc on soul and body.

The doctrine of continuity admits no exceptions; it has no "favoured nation" clause for man. Its teaching is of order, not confusion; of gradual development, not spasmodic advance; of banishment of all catastrophic theories in the interpretation of the history of man as of nature. In its exposition nothing is "common or unclean;" nothing too trivial for notice in study of the growth of language, of law, of social customs and institutions, of religion, or of aught else comprised in the story of our race. The nursery rhyme and the "wise saw" embodied the serious belief of past times; ceremonial rites and priestly vestments preserve the significance and sacredness gathering round the common when it becomes specialised. And in this belief in spiritual powers and agencies within and without, the line uniting the lower and the higher culture is unbroken. Nor can it be otherwise, if it be conceded that the sources of man's knowledge do not transcend his experience, and that within the limits of this we have to look for the origin of all beliefs, from the crudest animism to the most ennobling conceptions of the Eternal.

> "This world is the nurse of all we know,
> This world is the mother of all we feel."

And yet we find scientists shutting their eyes to the light. The Theistic philosopher, trembling at the bogey of human automatism, creates an Ego, "an entity wherein man's nobility essentially consists, which does not depend for its existence on any play of physical or vital forces, but which makes these forces subservient to its determinations."* The Biologist, shrinking from the application of the theory of evolution to the descent of man, argues that "his animality is distinct in nature from his rationality, though inseparably joined during life in one common personality." His body "was derived from pre-existing materials, and therefore, only derivatively created; that is, by the operation of secondary laws. His soul, on the other hand, was created in quite a different way, not by any pre-existing means external to God himself, but by the direct action of the Almighty symbolised by the term "breathing."† As

* Dr. Carpenter's "Mental Physiology," p. 27.

† St. Geo. Mivart's "Genesis of Species," p. 325. In the 2nd edition of this work, Professor Mivart cites with satisfaction the authority of S. Thomas Aquinas and of Cardinal Newman on the matter.

this compound nature of man is defended in a scientific treatise, and KNOWLEDGE is concerned with its scientific side alone, the question that leaps to the lips is, when did the direct action take place—in the embryo, or at birth, or at the first awakenings of the moral sense? Readers of that eccentric book, "The Unseen Universe," published some eight years ago, may remember that the authors built up a spiritual body whose home lay beyond the visible cosmos.* Their argument was to the following effect:—Just as light is held to result from vibrations of the ether set in motion by self-luminous or light-reflecting bodies, so every thought occasions molecular action in the brain, which gives rise to vibrations of the ether. While the effect of a portion of our mental activity is to leave a permanent record on the matter of the brain, and thus constitute an organ of memory, the effect of the remaining portion is to set up thought-waves across the ether, and to construct by these means, in some part of the unseen universe, what may be called our "spiritual body." By this process there is being gradually built up, as the resultant of our present activities, our future selves; and when we die our consciousness is in some mysterious way transferred to the spiritual body, and thus the continuity of identity is secured.

> Eternal form shall still divide
> Th' eternal soul from all beside.

We may well quote the ancient words: "If they do these things in a green tree, what shall be done in the dry?" The physicists, who thus locate the soul in limitless space, and call it vibrations; the mathematician, who said it must be extension; and the musician, who said, like Aristoxenus, that it was harmony; the Cartesian philosopher who locates it in the pineal gland; the Costa Rican, who places it in the liver; the Tongans, who make it co-extensive with the body; and the Swedenborgians, who assume an underlying, inner self pervading the whole frame—these have met together, the lower and the higher culture have kissed each other.

The tripartite division of man by the Rabbis, the Platonists, the Paulinists, the Chinese, the mediæval theories of vegetal, sensitive, and rational souls—what are these but the "other self" of savage philosophy writ large? Plato's number is found among the Sioux: of their three souls one goes to a cold place, another to a warm place, and the third stays to guard the body. Washington Matthews, in his "Ethnology and Philology of the Hidatsa Indians," says:—"It is believed by some of the Hidatsa that every human being has four souls in one. They account for the phenomena of gradual death, when the extremities are apparently dead while consciousness remains, by supposing the four souls to depart, one after another, at different times. When dissolution is complete, they say that all the souls are gone, and have joined together again outside the body. I have heard a Minsutaree quietly discussing this doctrine with an Assinneboine, who believed in only one soul to each body."

Let it not be thought that because science explains the earthborn origin of some of man's loftiest hopes, she makes claim to have spoken the last word, and forbids utterance from any other quarter. The theologian is not less free to assume such miraculous intervention in man's development as marks him nearer to the angel than to the ape, only his assumptions lie beyond the scope of scientific inquiry. And it should be noted that whilst science takes away, she gives with no niggard hand, so that the loss is more seeming than real.

When belief in the earth's central and supreme place in the universe was surrendered at the bidding of astronomy, there was compensation in the revelation of a universe to which thought can fix no limits. And if man is bidden to surrender belief in his difference in kind from other living creatures, he will be given the conception of a collective humanity whose duties and destiny he shares. That conception will not be the destruction, but the enlargement, of the field of the emotions, and, in contrasting the evanescence of the individual with the permanence of the race, he may find a profounder meaning in the familiar words—

> "We are such stuff as dreams are made on,
> And our little life is rounded with a sleep."

* For criticism of this pseudo-scientific theory, see Professor Clifford's brilliant paper in "Lectures and Essays," Vol. I., pp. 228, ff.; and a review of "The Unseen Universe," by the present writer, *Fraser's Magazine*, January, 1876.

PLEASANT HOURS WITH THE MICROSCOPE.

BY HENRY J. SLACK, F.G.S., F.R.M.S.

A DADDY-LONGLEGS is not an insect treated by ordinary observers with much respect. Children laugh at it, and wonder at its readiness to leave a few legs in their fingers. Older folks find nothing elegant in its appearance, or graceful in its short snatches of flight across the grass. To the gardener and farmer it is an object of dislike on account of the damage its grub does to lawns and grass-land. Curtis, in "Farm Insects," says of it: "This universally-distributed and mischievous gnat, by dropping its eggs in the field, garden, and pasture-land, annually causes serious losses to the cultivator by the destruction of various crops as well as flowers." The ravages committed by it are sometimes enormous, whole fields of mangel-wurzel falling a prey to it, besides the ruin of potatoes, beets, cabbages, &c. There are upwards of thirty British species of *Tipulæ* or Crane-flies, the Daddy-Longlegs being the biggest. Their grubs are tough, hardy things, standing any amount of wet, and called in some country places Leather Jackets. Out of thirty species, Curtis only identified three as positively known to be a serious nuisance.

The profile of these insects shows how they got their name of Crane-flies, from the projection of the mouth organs, which, however, make a snout rather than a neck. The male of *Tipula oleracea*, the Daddy, is easily known from the female by the end of its abdomen being blunt and thick, while that of the female is tapering and pointed. Mr. Curtis says, "The eggs are laid by the females, I apprehend, as they fly, or when they rest amongst the herbage, and are propelled as from a popgun." This may be so when the nature of the ground suits, but the creature is supplied with an ovipositing apparatus consisting of two parts, one adapted, like certain forceps used by surgeons, to enlarge an orifice, and another to guide the eggs into the hole thus made. Fig. 1 represents these organs separated; the shorter one, which conducts the eggs, is opened wide to show its hollow jaws. The female often seems stuffed full of eggs, which, according to Curtis, may amount to three hundred or more at one time. The maggots are footless things, with black heads and good jaws. They change to pupæ from August to September, and are furnished with spiny rings, which enable them to work their way to the surface of the ground, and, when their emerging time comes, he says, thousands of empty cases may be seen sticking half out of the earth amongst the grass. The wings of the perfect insects, though long and fairly broad, do not make them

Fig. 1.

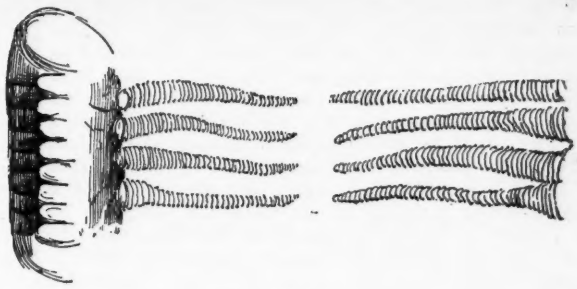


Fig. 3.

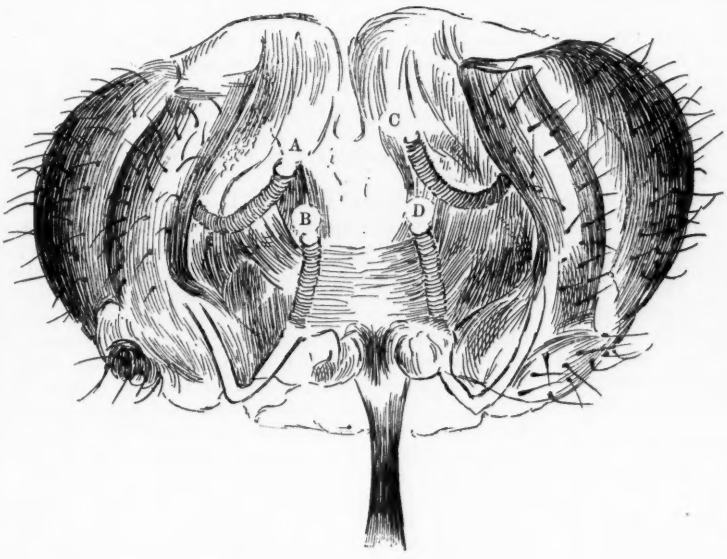


Fig. 2.

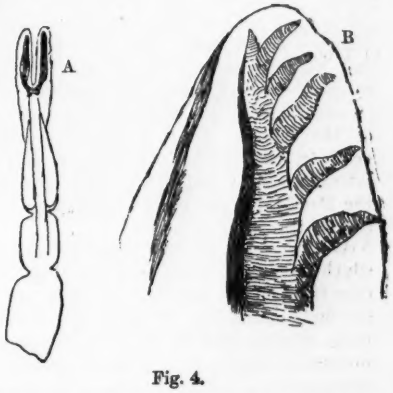


Fig. 4.

Fig. 1. Ovipositing Apparatus of *Tipula oleracea*.—A, ovipositor; B, forceps to move the ground and make room for the eggs (×10). Fig. 2. Tongue of ditto (×60).—Opening it to show structure, broke the large pseudo-tracheæ; A, B and C, D formed two curved vessels in their natural state. Fig. 3. Some pseudo-tracheæ in centre of the organ, the small ones springing from the larger; the large one omitted on right (×600). Fig. 4. A, Proboscis of *Rhingias rostrata* (×10); B, Portion of tip (×320).—The hairs and ornamental leopard spots are omitted. The lateral tracheæ are twenty-six on each lobe.

good flyers. Their outer margins are set with thick spines, the inner with larger and finer ones, and the intercostal spaces covered with minute hairs. The poisers are very conspicuous, and look like long-handled battledores. They are well worth mounting in Canada balsam, and are more winglike in aspect than those of most other flies.

The antennæ are long; composed, according to Westwood, of from thirteen to sixteen joints. Those of a female now before the writer has the former number. Mounted in balsam, they show each joint to commence with a slight bulge from which spring four bristles. All the joints are covered with numerous fine hairs springing from transparent spots, which have a pretty effect in a good light or with dark ground illumination. The snouty projection is in front of the antennæ, and carries at its tip two four-jointed palpi and the remarkable tongue. The last joint of the palp is beautifully ringed.

The tongue is the most marvellous specimen of the blow-fly pseudo-tracheal sort the writer has met with. It is short and broad. On each side is a thick, fleshy cushion, covered with bristles on its outer surface; inside are very numerous groups of pseudo-tracheæ, and in the centre a thinner portion also abounding in them. The Blow-fly, or the Drone-fly proboscis opens and shuts its two lobes, much like the opening and shutting of a book. The tipula tongue is more like the form obtained by the curve of two human hands holding a big apple within their grasp. The general shape is shown in Fig. 2, sketched from a specimen mounted, without squeezing, in a shallow cell of Canada balsam. It is slightly altered in appearance by being forced open, which has broken the large pseudo-tracheæ in the central portion, and put the two halves a little way apart. Fig. 3 shows a few of the pseudo-tracheæ in the centre of this organ, as seen with an oil immersion $\frac{1}{12}$th and "A" eye-piece.

It is difficult to count all their pseudo-tracheæ, as, when the tongue is whole and in its natural state, many are not visible from the superposition of parts, and taking it to pieces accurately requires much patience and skill—more than the writer can boast of. The number, however, seems about 300, and for our present purpose a few more or less do not matter. There is an enormous advance in the complexity of this organ, not only from such a simple form as that of *Rhingias rostrata*, but also from that of the Blow-fly or the Drone-fly. Of what advantage is it to the Daddy-Longlegs to possess

such an elaborate and complicated feeding machine? Does anybody know? The writer confesses complete ignorance, and will not venture a guess. Books are so generally mere compilations, one from another, that it is little wonder that those ordinarily accessible contain no account of this organ; but it is curious that its complex structure seems to have escaped Westwood at the date (1840) of his excellent "Classification of Insects." From his sketch it is evident he had only seen the tongue with a very low power. Figuier, in his "Insect World," says of the *Tipulæ*:—"The perfect insects, at first sight, resemble gnats; but are without a trunk, or rather their trunk is extremely short, terminating in two large lips. The sucker is composed of two fibres only." Where did he get this notion? If any reader has met with a good description of this tongue I should be glad to know of it.

A curious question arises with respect to an organ of this character in reference to the theory of development: What did the ancestors of the present creatures do while the thing was developing? A comparison of the mouth-organs of various dipters may throw light upon the Daddy-Longlegs case. The *Tabani* (breeze-flies) and others have, besides the proboscis, piercing and cutting tools and a pump. If in any insect the latter became gradually obsolete or imperfect while the former was growing, no inconvenience would arise. The gnats are piercers and pumpers; and perhaps remote progenitors of Daddy-Longlegs had as good lancets, saws, and pumps, while the proboscis passed from simple stages to the marvellous development of the *Tipula*. Fig. 4 shows the tongue of *Rhingias rostrata*, like dentist's forceps, with few and very short lateral tracheæ, and if we could find an early ancestor of the Daddy, his proboscis might afford still simpler exhibition of this kind of organ.

With regard to my paper on the Drone-flies, let me thank Mr. John Moore for his kind offer, and his remark that their food is not exclusively liquid, as he finds pollen in their stomachs. I have no doubt he is right, but their regular diet is, I think, obtained by sucking the nectar of florets, and I have examined many which had not swallowed pollen or other solid matter.

NOTES ON COAL.

By Richard A. Proctor.

(*Continued from p.* 334.)

IN all such progressions as we are here dealing with, statistics indicate a *wave-like* alteration. Just as in the shape of a wave's front, we see a gentle slope, then a more rapid slope, and then, up to the wave's summit, a gradually diminishing slope, so, in statistical progressions, we recognise a gradual increase at first, then a more rapid increase, then a diminishing increase, until the absolute maximum is reached, after which comes a gradual decrease. But the rear of such a statistical wave may be altogether unlike the front—in other words, the rate and manner and variations of decrease may be quite unlike the rate and manner and variation of increase. It is so with the progress of epidemics, with changes of population in the complete history of a nation from its rise to its decadence, with the growth of a trade, with every known subject to which statistical research has been applied. There may be alternate wave-like rise and fall, there may be so slow a rate of increase or decrease that the crest or valley of the wave seems long in passing, and the decrease after increase, or *vice versâ*, may so far differ from the preceding phase as to be almost imperceptible; but in every case there is to be recognised, either once or more than once, the wave form of rise or of fall.*

Now, the consumption of coal is at present, and for very obvious reasons, passing through the more rapidly-ascending portion of its wave of increase. For many years after the first recognition of the value of coal as fuel, the mineral crept slowly into use. With its employment, fresh uses for it were found, the very usefulness of the mineral suggesting new wants. Chief among the results which sprang directly from the use of coal as fuel, was the application of the steam-engine to a number of purposes which had before been either unthought of or unattainable for want of proper fuel. The spread of manufacture, of trade, of travel, and general intercommunication, followed in due course, at once directly and indirectly necessitating a continued increase in the quantity of coal employed throughout the Kingdom. These causes are still in full operation; and it is to be expected that, while this is the case, there will not merely be a steady annual increase in the use of coal (for such an increase would follow from the mere expansion of the uses already discovered for the mineral), but an increase of that increase, on account chiefly of the progress of invention and discovery.

That this state of things will continue for several years to come may fairly be anticipated; that for many years to come the average rate of increase in the coal-consumption will be fully equal to that at present observed may also be expected; but that, before many years are passed, the rate of increase (then higher than now) will be beginning to diminish, thenceforward returning towards its present rate, and passing eventually below its present rate, is to be looked forward to as the natural order of events in the future. Let it be remembered that such a result would by no means imply a falling-off in the commercial and manufacturing activity of the country. The extension of the employment of coal for known uses has, in several instances, already nearly approached a limit. In other cases, such extension, though still proceeding, is not proceeding at an increasing but at a decreasing rate. This must happen in turn with all the known applications of coal, the extension of its use perhaps attaining a rate corresponding nearly to that of the actual growth of our population.† Such a change would imply a continual increase of national commercial prosperity, not (as at first view might seem to be the case) a gradual decadence. It is as though a merchant, whose gains, already large, had been increasing year by year, say by £1,000, should find them still increase year after year by £900, £800, £700 (the change occupying many years), until, at length, the

* Let any one try such an experiment as the following, and he will readily understand what is here meant by wave-like progression, and obtain also very convincing evidence of the fact in question. Along a horizontal line let equal spaces be measured, and let a set of vertical lines be pencilled through the divisions on the horizontal line. Now, from the weekly records of health let the number of deaths due to any disease, or form of disease—as, for instance, diarrhœa, or the class of diseases included under the head zymotic—be noted from the commencement to the end of some period in which such diseases may have been particularly active, and let the number of deaths in successive weeks be represented on any convenient scale on the successive vertical lines, measuring upwards from the horizontal line. [For example, say that fifty deaths shall be represented by one inch, and other numbers proportionately.] Then through the summits of the lines thus drawn let a curve be swept. It will be found that this curve has the wave-figure spoken of above.

† The population is increasing at an increasing rate at present; but as this rate is much lower than that at which the consumption of coal is increasing, this consumption, in changing to the rate at which population is increasing, must diminish its rate of increase. Moreover, the increase of the rate at which the population of this country is increasing, grows less, decade by decade.

annual increase settled down to some constant or nearly constant sum, such as (say) £200. The prosperity of such a merchant could hardly be regarded as failing; for his gains, large at first, would have grown larger and larger throughout, and in the final stage they would still be growing larger and larger from year to year. So it would be in the case of those uses of coal which are already known. Already large, they would grow larger and larger (on our supposition, which we believe to be in accordance with all experience); they would not throughout the change fail to increase; and, at the last, they would settle down to a nearly constant rate, *not* of consumption, but of increase of consumption.

So soon as such processes begin to operate freely (and, as we have said, they are already operating to some extent) they will reduce the rate at which the whole consumption is increasing. Operating against them would be the progress of invention, by which fresh uses for coal are continually springing up. Yet this cause would not act *solely* to increase the consumption; for many of the inventions which require directly or indirectly the employment of coal, operate to remove or to reduce some other cause also requiring the consumption of coal. Nor is it at all unlikely that before long inventions will be so directed as to reduce in a very marked manner the consumption of coal in certain departments of trade and commerce.

Now, if this view of the future is just, we can no longer apply a percentage of increase after Mr. Jevons's method, except for so moderate a number of years that the monstrous annual consumption indicated for 1950 (for example) is no longer in question. For the next ten, twenty, or even thirty years, it is not vitally important whether we take Mr. Jevons's method or Mr. Hull's. There would, indeed, be a considerable difference in the annual consumption at the end of the ten, twenty, or thirty years; but still the main difference would be that a certain consumption would be reached so many years sooner in one case than in the other.*

Thus, taking 120 millions of tons as the annual consumption in 1872, and 3·26 as the rate of increase per cent. per annum, the annual consumption in 1882 would have been estimated at 159 millions of tons if the actual increase remained constant, and 165 millions of tons if the percentage of increase remained constant; at the end of twenty years from 1872 the numbers would be respectively 185 millions and 227½ millions; at the end of thirty years from 1872 they would be 218 millions and 314 millions. The difference in the last two cases is no doubt considerable; yet it is seen that the consumption in 1892, on Mr. Jevons's hypothesis is the same as the consumption in 1905 on the other; and it can readily be calculated that the consumption in 1902, on Mr. Jevons's hypothesis, is the same as the consumption in 1922 on the other. The advance to that rate twenty years earlier or later is a matter of very little importance compared with the question whether Mr. Jevons's view will be justified during after years.

If, on the contrary, as I believe, the present increasing rate of increase will be changed long before even thirty years have passed into a decreasing rate of increase—if such a consumption as 250 millions of tons is not reached until long after the time when even the present rate of change, continued uniformly, would have brought it—we need not fear that the exhaustion of our coalfields is so near at hand as either Mr. Jevons or Mr. Hull has supposed. And we may recognise this further cause of hope in such a view, that, whereas the prospect of the exhaustion of our coal within 150 or 200 or even 300 years would imply little less than the prospect of approaching national bankruptcy, the continuance of our supply for 800 or 1,000 years would suffice to put us on a secure and stable footing. During all these years the power and wealth of the nation would be increasing, so far as the cause in question is concerned (since our assumptions imply a continual increase in the consumption of coal); inventions and discoveries would have multiplied on all sides; means might even have been devised for accomplishing, without coal, the greater part of the work which coal now does for us; and at the worst we should be in a position to obtain abundant supplies of coal from other countries. It is not, however, too much to say that, even if these hopes were not justified, 1,000 years of prosperity is a future which this nation might contemplate with satisfaction. Whatever our pride in our country—in her past history, her present condition, or her future prospects—we are to remember that it is not given to any nation to endure for ever. As the most powerful nations of antiquity passed into decadence, so one day must it happen with this country, though we, her children, may well believe that that day is far off, and that the might and prosperity of this nation will rather undergo a change of form than a complete destruction—not perishing, but being merged in the might and the prosperity of one or other of the nations which have sprung from ours.

* In my original paper, which appeared in 1872, and has, of course, been modified above, I wrote as follows:—"It will be very soon in our power to decide whether one or other hypothesis be correct; nor will it be long before it will be possible to decide whether the hypothesis advocated by myself is not sounder than either. I venture to predict that before the year 1890 the percentage of increase will be markedly below Mr. Jevons's estimate; and that before the year 1900 the actual increase will be below its present value (3,500,000 tons)." The consumption appears now (in 1884, and judging from the records for 1883) to be about 164 millions of tons, which is considerably below Mr. Jevons's estimate, and shows that the first part of my prediction was sound; whether the latter part will be confirmed remains to be seen. As the average increase in the 11 years, from 1872 to 1883, has been nearly 4,000,000 tons, it is evident that when due account is taken of the reserved diminution of the rate (not the *amount*) of increase, the tendency of events is towards the fulfilment of this part, too, of my anticipations.

A LECTURE was delivered on Tuesday at the Royal Victoria Hall, by the Rev. W. Tuckwell, Rector of Stockton Rugby; the subject being a Bank Holiday on the Hills. The lecturer supposed his hearers to accompany him to some hill within reach of London by excursion train, and to spend the holiday upon it. He led them through roads and fields fringed and carpeted with summer flowers to the hillside, resting for a while beside a rustic home to look at the cottager's bees, and hear from him a delightful history of their culture. Past bogs blue with forget-me-not, yellow with asphodel, gleaming with sun-dew; through a wood where the squirrel and the wood-pigeon sat aloft, the golden-rod and foxglove waved below; along the hillside with its bracken, its whortle-berries, its heather, and its staghorn moss; the party climbed to the top, sat down to enjoy the sights and sounds, measured the height ascended by means of an aneroid barometer, discussed the geological formation of the hill itself, read chapters of English history in the view from its summit. In the walk which followed the flowers all around, pimpernel and St. Johnswort, and Lady's Bedstraw and club-moss, were made to yield their legends and associations; the viper, the burying beetle, the gossamer, the wasp's nest, suggested curious talk; a pond revealed mysteries of the stickleback's nest, and the dragon-fly's transformations, and the transparent water-flea, and the house-building Milicerta; a stone quarry exhibited Ammonites and Saurian remains and Coprolites of a million years ago, while flint implements from a gravel-pit told their tale of earliest man. Finally, a farmhouse gathered the excursionists to tea and country fare, and the happy day found its end, with certainty that its thoughts and feelings would penetrate the dust and heat of town life like a refreshing breeze from the hills themselves, a reminder of pleasures past, a provocative to renew them on many a future holiday.

"CRACKLE" GLASS.

THIS variety of glass, which has become so fashionable on account of its effective and crackled appearance, is, according to the *Glassware Reporter*, very easily made.

It is produced by covering one side of a piece of plate-glass with a thick stratum of a flux or readily fusible glass, mixed with coarse fragments of glass. In this condition it is placed in a muffle, or an open furnace, where it is strongly heated. As soon as the flux is melted and the glass itself has become red-hot, it is removed from the furnace and rapidly cooled. The flux (or fusible glass), under this treatment, cracks and splits, leaving innumerable fine lines of fracture over its surface, having much the appearance of scales or irregular crystals, which cross and intersect each other in every direction, producing very striking and beautiful effects when the light falls upon its surface.

The rapid cooling of the fusible coating is effected either by exposing the heated mass to the action of a current of cold air, or by cautious sprinkling with cold water.

By protecting certain portions of the glass surface from the action of the flux, these portions retain their original smoothness and polish, and form a striking contrast to the crackled portions of the surface. By this means inscriptions or decorative designs of every description are produced upon a colourless or coloured ground.

A modification of this method of producing crackle glass is the following: A coarsely granular flux is strewn upon the surface of a glass cylinder, while the latter is red hot, until the flux melts. It is then removed and rapidly cooled either by the use of water or by waving it about in the air. The stratum of melted flux is then caused to crack as above described. The cylinder is then cut, flattened, and brought to a level surface in the usual manner.

DICKENS'S STORY LEFT HALF TOLD.

A QUASI-SCIENTIFIC INQUIRY INTO

THE MYSTERY OF EDWIN DROOD.

By Thomas Foster.

(*Concluded.*)

I HAVE purposely kept to the last what I take to be the most striking proof of all that Edwin Drood was not really slain and that he communicated at once with Grewgious—a proof plain and striking, yet somehow entirely overlooked by all who have examined the story (except Mr. Proctor and myself, who take the same view of the plot).

When Mr. Grewgious had given the ring to Edwin which had been removed from the unconscious hand of Rosa's mother, he was sad and out of spirits. "I hope I have done right," he says: "*it was hard to lose the ring*, and yet it must have gone from me very soon." "He closed the empty drawer with a sigh, shut and locked the escritoire, and came back to the solitary fireside. 'The ring,' he went on, 'will it come back to me? My mind hangs about her ring very uneasily to-night. But that is explainable. I have had it so long and prized it so much.'"

This much-prized memento of his dead love was, he knows, in Edwin's possession when he disappeared. The watch, chain, and breast-pin which were also in Edwin's possession are found in Cloisterham Weir. Is it conceivable that Grewgious would have made no inquiry whatever about the ring he valued so much if he had supposed—as so many readers imagine he did—that Drood had been made away with? Is it conceivable that when feeling and duty alike (and with almost equal strength, we may say, when we consider that duty was a passion with him) urged Grewgious to seek for the ring, he would have overlooked his duty and set his feelings on one side, as he actually did, if he knew no more than the ordinary reader supposes? I answer unhesitatingly that this is not conceivable. It is absolutely certain that Mr. Grewgious had the ring again in his possession many hours before the watch, chain, and pin were found in the weir?

But we are told that in resolving to restore this very ring to his breast, Edwin was unconsciously preparing "a chain, riveted to the foundations of heaven and earth, and gifted with invincible force to hold and drag." The idea is suggested that the ring was to be found in the tomb when Edwin himself and his very clothes had disappeared through the action of the quicklime. But this idea a score of reasons have compelled us to abandon. How are we to reconcile what was said about the ring and our knowledge that Jasper is to be condemned to death for murder, with what we know to have happened to Edwin and with what we know to have been planned against Jasper.

Very easily, if we consider the course which Edwin's plans would naturally take after he had discovered what the old opium-eater knew or might learn. Among the revelations he was awaiting must inevitably have come the discovery that Jasper's main idea in removing the watch, chain, and pin was that they might afford no evidence against him in the tomb. So soon as Edwin and Grewgious had learned this, their power to inflict a very terrible punishment on Jasper would at once be manifest. They would see that the use of the watch, chain, and pin, to bring suspicion on Neville, was only an afterthought. They would feel that Jasper had planned to remove all trace of his guilt from the tomb into which he had flung his victim; and they would force on him the completion of his purpose. Edwin had himself removed from the tomb the only object which could have resisted the action of the quicklime. But of that ring Jasper had known nothing. What horror fell upon his guilty mind when he learned that he had unwittingly left a fatal witness of his crime, within the very tomb of his victim! His sense of security is at once utterly shaken. He broods over his danger, while he shudders at the thought of the only possible way of removing it. But, struggle as he may to resist, he is compelled at last to take this dreadful yet only available course. He is forced to the tomb itself, nay to the very dust of his victim, that he may there grope in darkness and horror for the evidence of his crime.

We may feel sure that a part of Jasper's penalty was to have been this,—to be driven by terror for his life to face the ghastly terror of his victim's tomb. Further, I have myself no doubt that the course of his fate was to have been so guided that his visit to the tomb was made on the same day of the year on which his attack had been made, and at the self-same hour of the night.

Creeping down the crypt steps, oppressed by growing horror and by terror of coming judgment, sickening under fears engendered by the darkness of night and the charnel-house air he breathed, Jasper opens the door of the tomb and holds up his lantern, shuddering at the thought of what it may reveal to him.

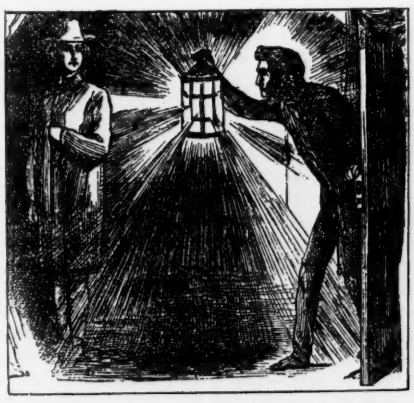
And what sees he? Is it the spirit of his victim that stands there, "in his habit as he lived," his hand clasped on his breast, where the ring had been when he was murdered? What else can Jasper deem it? There, clearly visible in the gloom at the back of the tomb, stands Edwin Drood, with stern look fixed on him,—pale, silent, relentless!

With a shriek of horror (the ghost of that awful cry had

been heard before by Durdles*), Jasper casts down the lantern and flies from the tomb. But even as he rushes forth he is faced by two men, from whom he turns (utterly unnerved by the horror of the tomb) to seek the only path of escape —the winding staircase of the Tower. They follow him closely, Neville first, Tartar close by him, Drood himself but a few steps behind Tartar, and Crisparkle following. Seized by Neville at the top of the staircase, Jasper turns and struggles fiercely with the man he hates. Neville receives his death-wound (but lives long enough to know that his name has been cleared), Tartar, Drood, and Crisparkle capture Jasper, and the villain is cast into prison, but not till he has been confronted by his supposed victim and by Grewgious and made to feel how, while he supposed himself safe, every movement of his had been known to them and watched by them. In the knowledge that Tartar loves Rosa and is loved by her, Jasper's punishment is complete.

Very little of this suggested close of Dickens's Half-Told Story is invented. Dickens himself told very nearly all of it, in what the story itself discloses unmistakably,† in what he said to Forster and to Miss Hogarth, and finally in the instructions to Mr. Fildes respecting the illustrations.

With regard to these illustrations, we know that a picture showing Jasper in Rochester gaol was to have appeared towards the close of the book. But there were earlier indications in Mr. Fildes' work under Dickens's instructions (and not explained to Mr. Fildes, of course, so far as their bearing on the story was concerned) which are full of meaning. Yet, strangely enough, they seem to have been quite overlooked by most readers. Or perhaps most of these read from the cheaper editions, in which the old illustrations of the paper covers to the monthly parts were not reproduced. I venture to give two of the small pictures from the love side of the cover, two from the murder side, and the central picture below, which presents the central horror of the story—the end and aim of the "Datchery assumption" and of Mr. Grewgious's plans—showing Jasper driven to seek for the proofs of his crime amid the dust to which, as he thought, the flesh and bones, and the very clothes of his victim, had been reduced.‡



Nothing more sensational had ever been invented in fiction than the terrible punishment devised for Jasper. Yet amidst the gloom and horror even of that part of the story there would have been found room for touches of humour and pathos after Dickens's best manner. When we consider the course of the other events which were to have led to the dénouement, we feel still more what a loss the missing half of this fine story has been to literature. The relations between Tartar and Neville would in particular have been full of interest. In the earlier part of the story we see Neville roused to fiery wrath with Drood,—but not because of rivalry. We feel that Neville, though proud and fiery, will not be moved to wrath by Tartar's love for Rosa; nay, that his own love for her will cause him to sympathise with the earnest love of the brave and honest sailor. The relations of Helen and Tartar would also have been a fine subject for such a pen as Dickens's. She would quickly feel that Tartar was worthy of Rosa, and both she herself and her brother, in their love and esteem for Crisparkle, would be naturally drawn towards the man who had saved Crisparkle so gallantly in early boyhood.

But most difficult to deal with, and therefore worthiest of Dickens's pen, would have been the relations of Edwin, after his identity had been revealed, with Landless and Tartar. Neville would have been more in sympathy with Edwin Drood — earnestly loving Rosa, loving her like himself without hope—than even with Tartar; and Edwin would now thoroughly sympathise with the feelings which had driven Neville to an outbreak of wrath against himself. Purified by trial, strengthened though saddened by his love for Rosa, Edwin would have been one of those characters Dickens loved to draw—a character entirely changed from a once careless almost trivial self, to depth and earnestness. Neville was to have died, but we may be sure not before he had learned to understand the change which Edwin's character had undergone. Between Tartar and Drood, though rivals awhile for Rosa's love, a warm friendship was to grow, in which Rosa, Helena, and Crisparkle were to share—while all were to join in changing the ways of dear old Grewgious from the sadness and loneliness of the earlier scenes to the warmth and light of that kindly domestic life for which, angular though he thought himself, his true and genial nature fitted him so thoroughly.

* A dog was certainly to have been introduced into the story —probably it was to have been Neville's (Crisparkle would advise Neville to get a dog-friend): and the "howl of a dog" was doubtless heard by Durdles after Neville's death, a few minutes after Jasper's shriek of horror.

† I include among these indications such remarks as Neville Landless's, that "He hoped he might live" to see himself cleared. Any one who understands Dickens knows as certainly from this that Landless will live so long and no longer, as if Dickens had said as much. In a similar way (to cite one from hundreds of cases when we are told in his "Wreck of the Golden Mary," that Mr. Rarx "*kept* his secret,") we know certainly that Mr. Rarx is marked down for death, early though the remark comes in the story.

‡ Above are shown Durdles's spade and bundle, and the great key of the tomb, from which we learn that near Durdles and the tomb the central meaning of the mystery is to be sought.

XUM

RAMBLES WITH A HAMMER.

GEOLOGY OF CRICCIETH AND PWLLHELI (*continued*).

By W. Jerome Harrison, F.G.S.

II.

PRE-CAMBRIAN ROCKS.—Of these rocks, of which it is in some degree doubtful whether they are (*a*) older than the Silurian strata which now surround them, or (*b*) of *later* date than such beds, being, in fact, intrusive in them, there are several examples near each of the towns to which this article refers. The picturesque old castle at Criccieth is built on a mass of columnar felspar—porphyry. It is a compact pinkish rock, in which distinct felspar crystals are here and there visible. About four miles west of Criccieth, the headland of Pen-y-chain gives a most interesting section. Approaching it by the shore from the Afonwen side, we meet with (1) a compact felsitic rock resembling that of Criccieth; (2) a dark-coloured rock, such as the older geologists called "greenstone"; (3) a remarkably laminated bed, the laminæ (about the tenth of an inch in thickness) being alternately green and white in colour (this may be a schistose gneissic rock or a laminated volcanic ash; it requires microscopic examination); (4) another bed of "greenstone;" (5) a beautiful breccia — either a volcanic agglomerate or a shore conglomerate little rolled, consisting of masses of a pale felsitic rock like (1) embedded in a dark matrix like (2). The included fragments increase in size as we cross the strike of the bed from the size of a marble until they are a foot in diameter, and the larger the fragments are the less of the dark matrix is seen between them, until at last they are almost in contact with one another. Continuing in a westward direction we cross (6) a platy felspathic rock, and then in a little cove we find a very remarkable mass of (7) chalcedonic nodules, the sizes varying from a fraction of an inch to several inches in diameter. (Similar nodules occur in the little promontory of Careg-y-defaid, two miles south-west of Pwllheli.) Beyond this comes more of (8) the platy felspathic rock, and finally (9) more of the compact felsite, forming precipitous cliffs from which sea-fishing with the rod may be carried on.

All the nine varieties of rocks which we have described are lumped together by the Geological Survey in their map and memoir as "felspar porphyry" intrusive in Silurian strata. My own opinion is that they are in part, at all events, of immensely greater antiquity, and very probably of Pre-Cambrian age. The fragments in the breccia bed (5) must have been in their consolidated and hardened state when they were broken up to form the layer in which they now lie. This breccia bed is, therefore, of *later* date than the felsites from which its materials were derived. All these beds appear to be of volcanic origin, and of contemporaneous volcanic action of this kind the Bala beds (as those Silurian rocks are called which rest upon the flanks of Pen-y-chain) of Lleyn offer few or no traces.

Walking on four miles more—still westward—to Pwllheli, a remarkable section is exposed in the deep cutting through which the road passes to the little villages of Llanor and Denio. Here shivery slates of Bala age are broken through, and cast into wonderful contortions by a felspathic rock which forms a bold ridge several miles in length. Here it might appear that we have clear evidence of a mass of molten rock (for the felspathic rock is clearly of an igneous character) having burst through the Silurian slates, and I cannot say (in the absence of fuller investigation than time permitted me to give) that such is certainly not the case. But what puzzled me was the slight evidence of alteration afforded by the slaty strata. They did not appear to be more indurated near the junction, and fossils could be found in them quite close to the felspathic rock. It is, then, possible that the disturbed junction between the two rocks may be a line of fault, and that the felspathic rock, already in a hardened state, was forced, like a wedge, through the newer overlying slates. The occurrence in this cutting of a brecciated bed, in which fragments of a pale rock were embedded in an ashy matrix, a bed which apparently belonged to the felspathic rock, strengthened this belief. In this case it is probable that all this ridge of hard rock is of the Pre-Cambrian age. At the south-west end of Pwllheli, near the old turnpike gate, there is an exposure of a volcanic ash or breccia, which may be a continuation of the breccia-bed just named. Prof. Ramsay writes that it is "the only rock in Lleyn of an ashy or brecciated character;" but in view of the magnificent breccias at Pen-y-chain and Porth-dinlleyn this is certainly an error. The other masses of igneous rock north and west of Pwllheli and Criccieth—coloured red on the Survey Maps, and considered by the professional geologists who made those maps as intrusive masses in the Silurian strata—all, or nearly all, are claimed by Dr. Hicks as belonging to his immensely old Pre-Cambrian rocks. But if these hills —for the hard, igneous masses all stand up boldly above the softer Silurian slates — are Pre-Cambrian, where are the *Cambrian* strata, which ought to lie *between* the Pre-Cambrian beds and the Silurian strata? Dr. Hicks accounts for the absence of Cambrian strata round Mynydd-y-cennin, Yr Eifl, the Nevin, and Boduan Mountains, &c., by calling in the aid of *faults*, by which, he says, the Pre-Cambrians have been thrust upwards while the Cambrians are left below. This may be, and no doubt very frequently is, the case. A further explanation may be found in the *overlap* of the Silurian beds which has sometimes covered over and hidden from view the junction of the Cambrian and Pre-Cambrian strata (Fig. 1). Our knowledge of the Pre-Cambrian beds of Lleyn is, however, as yet extremely small, and much work must be done before their true nature, extent, and relations are made clear.

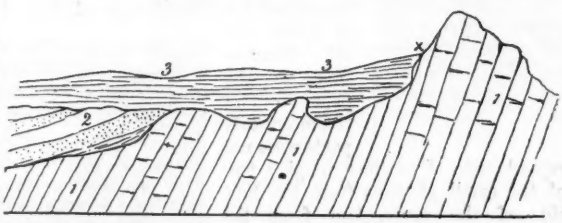


Fig. 1.—Overlap of Silurian strata (3, 3) by which they abut upon the Pre-Cambrian rocks (1) at ×, thereby entirely hiding from view the Cambrian beds (2).

The land-locked harbour of Pwllheli owes its existence to the great boss called the "Gimlet Rock" (Welsh, *Carreg-y-rimbill*), which lies at the entrance to the harbour, and serves the purpose of a pier or breakwater. It is a very handsome rock, a diabase, composed of the minerals felspar (white) and augite (black). Beautiful crystals of quartz occur in the fissures by which the rock is traversed. There are large quarries here whence excellent paving-setts are obtained, and similar quarries may be seen at many points round the coast, as at Llanbedrog, Nevin, and Porth-y-nant. The stone is largely shipped to Liverpool, but at present the demand for it is but small, and several of the quarries have ceased working.

(*To be continued.*)

THE WORKSHOP AT HOME.

By a Working Man.

(*Continued from p 356.*)

WHEN I was explaining the way of making a simple picture-frame on p. 356, I recommended the amateur to clamp it up by strips of wood nailed down on to a plank; and this method will serve very well if he is only going to make one or two. Should he, however, take a fancy to this kind of work, he had better construct the simple kind of clamp which I am going to describe, and which is shown in Fig. 24. He will find it very handy for

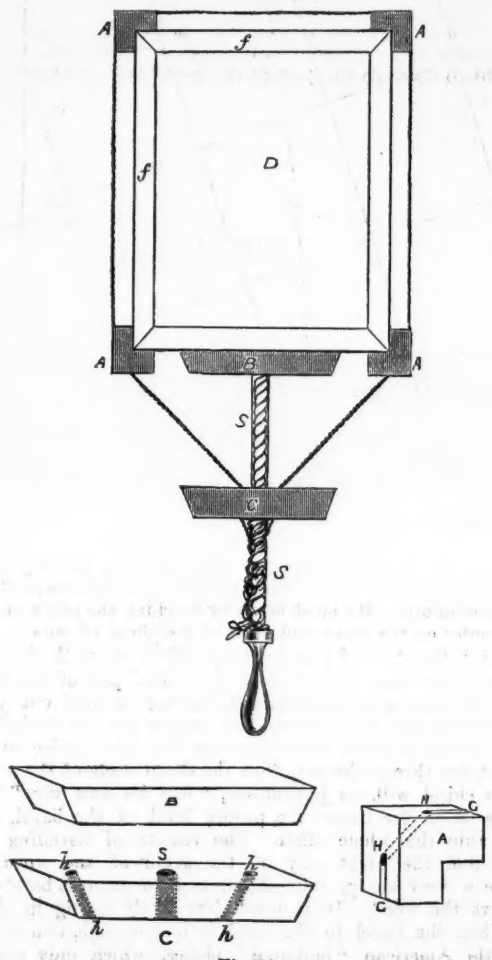


Fig. 24.

shallow trays with mitred corners, and similar things beside. I always use it myself. First and foremost we cut out four pieces of beech-wood into the shape shown at A; in the clamp now before me, the four longer sides of these measure 2 inches. Through these we bore diagonally from *h* to *h*, and cut the grooves *h g*, *h g*, from the holes *h h* to the ends of the blocks. Now cut two pieces alike, as shown at B and C. Drill a hole in the bottom of B a quarter to half-way through it. This is to take the end of the screw immediately to be referred to. It is a wooden one cut in a "box," and if the amateur does not possess such a box, he can buy a screw like S (in D, above) for a few pence. C must be tapped to take this screw, as shown at S; the diagonal holes *h h*, too, must be bored through it. It only remains to thread a sufficiently stout piece of cord through the four pieces A and C, and our clamp is complete. It is shown in action in D. The frame *f f* having been glued up, the four pieces A are placed one at each corner, and B against one edge. Then the two ends of the string are firmly attached to the handle of the screw previously passed through C, as are the strings too, and the end of the screw is inserted in the hole at the bottom of B. A glance at the figure will show how, by turning the screw, the string is tightened, A A A A caused to approximate, and the included frame *f f* tightly clamped up.

While we are talking about picture-frames, though, by far the prettiest and most effective frame that the amateur can make is what is known as the "Oxford" one; in which instead of the corners being mitred and square, the sides and ends cross each other and project, as shown in Fig. 25. It will be noticed, too, in the sketch, that the

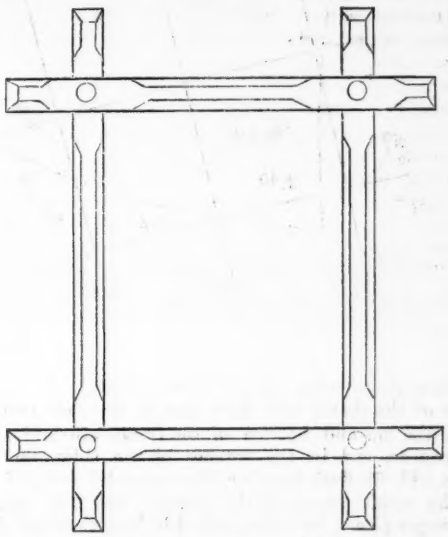


Fig. 25.

edges of the piece of wood are what is called "stop-chamfered"; that is to say bevelled at an angle of 45°, in (if I may so speak) lengths, the bevel stopping at intervals and not extending all along the work. Let us suppose now that we are going to make an Oxford frame to take a "Cabinet sized" photograph, the mount of which will measure about 6½ in. by 4½ in. Oak is very commonly used for these frames, but I have myself made a great many from walnut wood, which is very pretty and effective, and, with

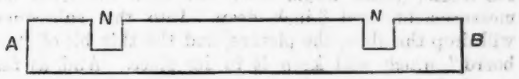
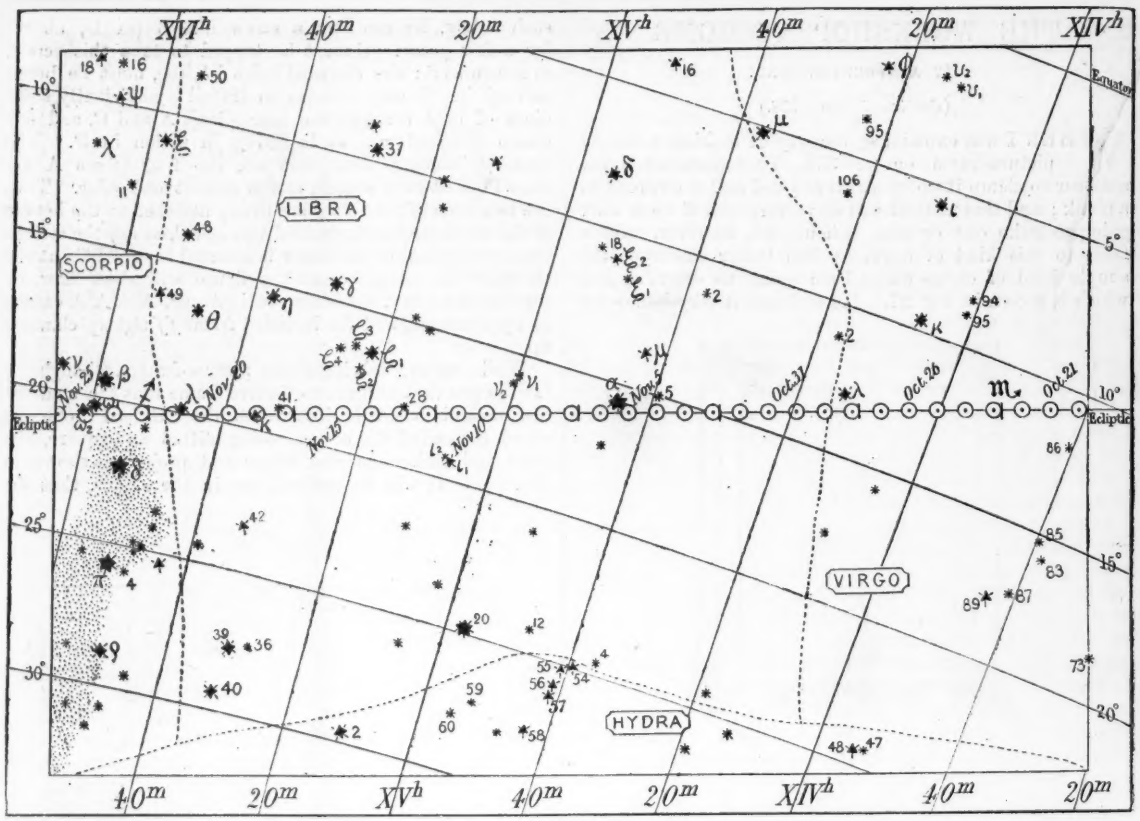


Fig. 26.

moderate care, easy to work. First we must square up four bits of wood ⅜ in. wide and ¾ in. deep, two of them 9½ in. long, the other two 7½ in. long. These are to be (what workmen call) "halfened" together. Fig. 26 explains this. Here A B represents one of our pieces of wood in which the notches N N are cut ⅜ in. wide (the width of the wood) corre-



Day Sign for the Month.

sponding pieces being cut out of the others. A very little study of the sketch will show that if these are truly cut, when the top and bottom of the frame are laid notches downwards, and in the notches of the sides, the whole frame will fit flush together, like one solid piece of wood. If the inside edges of the notches are 6 in. apart on our longer pieces, or sides, and 4 in. apart on our shorter pieces, or top and bottom, we shall have a solid frame measuring 6 in. by 4 in. inside. We will look it over and see which face looks the best, and that shall be the front of our frame. Now our photograph is $6\frac{1}{2}$ by $4\frac{1}{2}$ in., so by aid of the marking-gauge (Fig. 8, p. 154), we must mark a "rabbet" or rebate on the inside of the frame, $\frac{1}{4}$ in. wide, and $\frac{3}{8}$ in. deep. First marking our fitted strips with pencil, in order that we may restore them in their order, we take the frame to pieces, and, with a knife or chisel, cut the rebate out. If we now replace the pieces we shall, of course, have a depression at the back of the frame, $\frac{1}{4}$-inch larger each way than the *front* inside measurement, and $\frac{3}{8}$-inch deep. Into this subsequently will drop the glass, the picture, and the thin bit of "scale-board," which will keep it in its place. And, as far as merely holding the picture is concerned, we may regard our frame as finished; but we want to have it ornamental as well as useful, so we must proceed to the more decorative part of the work. So far it has all been pretty plain sailing; but I am rather afraid that at this stage the incipient mechanic will find that, in the words of a vulgar proverb, he is "like a young bear, with all his troubles before him." For he has now got to do the chamfering, which is far from an easy job; in fact, he may very possibly spoil his first frame altogether at this stage of its manufacture. He must begin by marking the edges of the chamfer on the front and sides of his pieces of wood; and then it is not a bad plan to saw nearly down to the lines at short intervals. This enables the initial part of the work to be done more cleanly. If, having marked out your chamfers and determined their length you go straight at them with a chisel, the chances are that after taking off the first few thread-like cuts from the sharp angle of the wood, the chisel will, as joiners say, "find its own way" into the wood far below the proper level of the bevel, and so ruin the whole affair. The secrets of bevelling are to find the right way of the grain of the wood, to use a very sharp, thin chisel, and to turn it bevel-side next the wood. It is much less likely to dig in then. When the bevel in the wood is long enough, one of the little American "bull-nose" planes, which only cost a shilling or eighteen-pence, may be used with advantage to make the central part of it. There is also what is called a "chamfer shave," which may be similarly used. The "stopped" ends, though, must be carefully finished with the chisel. Fig. 25 will serve as a pattern for the learner. Four little knobs or pins will be seen at the points of junction of the ends and sides of the frame. These are simply for ornament. I turn them myself out of old tooth-brush- or knife-handles, &c., when I am using dark-coloured wood, and out of ebony when the wood is of a light colour. I have endeavoured to make this description as intelligible as possible; but no amount of pictorial illustration can ever

Night Sign for the Month.

supersede, or be a substitute for, an examination of the thing itself. I strongly recommend the amateur, then, to obtain an old Oxford frame, take it to pieces, and to re-read this article with it in his hand. He ought not to have much difficulty in making another then.

(To be continued.)

ZODIACAL MAPS.

By Richard A. Proctor.

WE give this week both the day sign and the night sign for the month, one showing the zodiacal sign now high in the heavens at midnight, the other showing the region of the zodiac athwart which the sun pursues his course at this part of the year.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

II.—THE FRAMEWORK OF THE DWELLING-HOUSE.

GENERAL PRINCIPLES OF CONSTRUCTION.

DURING the past few weeks we have instituted a series of inquiries regarding the present state of knowledge amongst builders and others who are concerned in the establishment of dwellings in the vicinity of London, and we have been led to discover a few items of interest which may prove of value to some of our subscribers.

The vast majority of villa residences and superior semi detached houses are the outcome of plans submitted to capitalists by competent architects; they usually include most of the conveniences of a healthy dwelling, with the exception of certain details which are very apt to be overlooked as trivial or unimportant, but, which we shall show hereafter, are of considerable practical value. Altogether, however, there is but slight ground for fault-finding amongst this class of buildings, the reason being that they are the work of competent and well-trained professional men.

But let us turn for an instant to those other abodes which represent the major portion of our homes. They are tenanted by the middle, poorer, and labouring classes, and realise rents of from £15 to £40 per annum. They are generally erected under the following circumstances:—A capitalist, usually a working man "who has ris," invests a few hundreds through the agency of a practical friend, or other intelligent workman, whom he styles his foreman. It may happen that the foreman in question has had a good builder's education, and is fully aware of the advances that have been recently made; but it is more often the case that he is a man who can turn his hand to anything, from the nailing on of garden palings to the fixing of a "Long Hopper" basin. His architectural acquirements are based upon the practical information he has derived during his apprenticeship and journeymanship in the work connected with larger and well-constructed houses, but he falls short when he comes to apply his knowledge as a supervisor, inasmuch as his training is devoid of those thoroughly

sound and general principles, brought up to the requirements of the times, which characterise the labours of the cultured architect. The planting of D-traps, the dissociation of the household from the closet-cistern, the knowledge that a damp-proof course is useful; these are the utmost that we have found attended to in the most advanced types of the dwellings now under consideration.

By way of an example we propose to consider an averagely well-constructed house of moderate proportions; such a one as would realise an inclusive rent of about £30 a year. The capitalist endeavours to expend his funds to the best advantage, to erect a house which shall last for the period of his tenure of the land and no longer; and yet, through the excessive competition of his rivals, he is forced to make out that his commodity, if we may be here allowed to substitute such an expression, is all that could be desired. The would-be tenant, who is not only wholly ignorant of the geological structure of the chosen district, but also quite uninformed as to the suitable construction of a healthy house, is made to appreciate sundry innovations which are carefully pointed out to him, and he thereafter lives, happy and contented, in the midst of a disease-producing or aggravating neighbourhood, until its pernicious influences have done their deadly work. And yet all these evils are in vogue when only a slight excess of outlay could wholly obviate their existence.

The small capitalist, with his foreman to guide and direct him, invests in bricks of the commonest quality; fortunately cheap bricks are nevertheless reliable—at least, for the kind of work we are at present considering. He buys ingredients for mortars and cements; and once again the expenditure is a primary motive power. He is quite regardless of the nature of the sand used; it is probably sea-sand, thoroughly impregnated with the hygrometric chlorides which abound in salt water, and which, when mixed with mortars, is a perpetual cause of damp walls. The walls themselves are but a brick and a-half thick; they have scarcely time to dry, and aggravated by the employment of inexpensive and inefficient materials, result in a humid and cold suite of apartments, instead of a healthy and comfortable set of rooms.

Every house has a foundation, that could not very well be avoided. Every house, however, does not possess a suitably-constructed area of ground underneath it. It has long been known that swampy lands are unsuitable for building purposes; the consumption death-rate on clayey soil is far greater than that on dry pervious strata, and it can only be lowered by careful drainage. The causes of pulmonary and other deadly diseases have only recently been discovered; the researches of Pasteur, Koch, Lister, Ewart, Watson Cheyne, and others, in the domain of microscopical biology, have shown that those diseases are attributable to the growth and multiplication in the tissues of the lungs and other organs, of minute schizomycetous plants—*Bacillus tuberculosus* and its allies. These plants only thrive under suitable conditions of temperature and *moisture*, and it therefore stands to reason that houses built on swampy or badly-drained lands are susceptible to the invasion of the germs which cause zymotic diseases.

Now, although the unsuitable geological aspect of a tract of land, which is conveniently situated for building purposes, can be successfully modified by drainage so as to become adapted to the erection of homesteads, there is another thing which ought to be borne in mind by every builder:—His house, to be freed from the possibility of damp arising through the basement floor, ought to be built upon an impervious layer of cement, concrete, or asphalte. A substratum of this nature affords immunity from three dangerous or undesirable things, viz., when the joists of the floor rest upon a consolidated area—(α), damp is avoided; (β), suitable ventilation becomes easily and perfectly possible, and dry rot is thus prevented; (γ), vermin, such as rats, mice, &c., are effectually excluded. Amongst the numerous houses which we have lately examined, whether completed or in progress, we have not found a single good example; yet, the greater number of houses near London are built upon clayey soil, but imperfectly drained, as is clearly attested to by the pools of water which remain in the roads for several days together after a shower of rain.

In ancient times, when our ancestors built walls several feet in thickness, they thereby diminished the possibility of damp houses; but in the present day, when economy regulates the thickness of a wall, something else must be done. Apart from hygrometric mortar, damp is very liable to rise in the walls of a building, and make it unhealthy, for reasons which we have already indicated. It is necessary to extend the impervious layer beneath the basement floor, through the walls. Such an extension, or damp-proof course, as it is technically termed by modern builders, ought to be specially well constructed. When architects first became aware of the value of the damp-proof course, their attempts, although valuable, were capable of vast improvement; the counteracting influence of expenditure again became manifest in the introduction of a thin layer of tarred felt as a preventive to the rise of damp in walls. Many houses which we have inspected have no damp-proof course at all; the more enlightened of the aforesaid foremen use the tarred felt, but we are sorry to state that we have not yet discovered a single abode in which an efficient protection from damp is secured. The damp-proof course ought, if anything, to be more rigorously looked after than the impervious sub-basement; it ought to be perfect, especially at the exposed corners of houses, where damp is most liable to rise.

The circulation of fresh air without draughts underneath the basement, is only second in importance to its introduction, under analagous conditions, into the inhabited apartments. In small and moderate-sized rooms, such as those which constitute the class of houses we are at present discussing, an efficient fireplace and suitably-constructed windows are amply sufficient. The frames of the upper and lower sashes of each window ought to be very accurately fitted; the meeting rails, especially those at the middle, should be broader than the accepted inch or inch and a half; and the bead on the window-sill ought to be deep instead of narrow. The value of a deep bead may be said to be two-fold, (i), when the lower sash is raised, the inrush of air is directed upwards instead of directly to the door or fireplace, thereby acting as a ventilator instead of a draught-producer. This simple form of ventilator becomes all the more efficient when the upper edge of the deep bead is cut at an angle of 45°, or somewhat less; (β), when the lower sash is raised during a shower of rain, the fresh air can gain access to the apartment to the exclusion of the wet; this is particularly desirable in a bedroom.

We shall continue the subject of ventilation in our next communication, and follow our remarks by a notice of some of the most reliable contrivances that have hitherto been brought forward, in practical illustration of our foregoing observations. In this way we hope to point out what is desirable in the framework of a modern dwelling-house, and show our readers how those desiderata may become available.

THE paragraphs on "The Moon Eclipse" and on "The Action of Moonbeams," which appeared as quasi-editorial ones among our "Miscellanea" on pp. 369 and 370, were received from our esteemed contributor, Mr. H. J. Slack, F.G.S., &c., and should have borne his signature.

OUR SCIENTIFIC INDUSTRIES.

By W. Slingo.

GAS AND ITS USES.

I.—Manufacture.

THIS series of papers will obviously take a wide range of subjects—subjects, too, in which our readers must be more or less directly interested. The object in view is to present in as readable form as possible some of the very many commercial pursuits which are largely based on scientific principles. At first thought it might appear that no industry would be outside this category; but a little consideration will render apparent the fact that very many of our industries are not only weak in scientific bases, but that they are frequently more opposed than conformable to science. The end and aim of Knowledge, however, is not only to disseminate scientific information, but also to indicate new paths for scientists to tread. Consequently, reference to unscientific industries will occasionally be necessary, if only to point out the way in which the teachings of science may be advantageously applied.

The gas industry has been chosen as the first upon which to expatiate, not because of its paramount importance, but rather because it is one which appeals directly to everybody and which is of considerable interest in many directions.

Notwithstanding all that has been said and done in the way of promoting the electric light since the inauguration of the Paris Exhibition of 1878, it is manifest that the extent to which the new illuminant has been adopted is but a shadow—and that only a faint one—of what was so fondly hoped for by the crowd of too-enthusiastic promoters. Several hundred thousand pounds have been risked and lost in the venture, and doubtless many more will, ere long, share the same fate. Nor is this much more than might have been expected, even had attention only been directed to the fortunes and misfortunes which have attended the introduction of any novelty in previous times. George Stephenson had much more trouble in all directions than have waited upon electricians before he was able to demonstrate the real worth that lay hidden in his ideas. Amongst the many adversaries contending with him and many other progressive luminaries, ignorance, prejudice, and scepticism were not the least hurtful, but the day when such enemies may testify their potency has gone, and surely the electric light has suffered but little from either. All that electricians have to do is to prove that their apparatus can do what they claim it to be capable of doing, and that it shall do it at a price somewhere near what we are now paying for similar benefits derived, may-be less pleasantly, from other sources. There are many points about which electricians have been less careful than they should have been. They seem to have run away with the idea that, being able to demonstrate that light could be produced by the agency of electricity, they had done their share in introducing the new system. The troubles and reverses suffered by them during the past six years, however, have been sufficient to impress them with the necessity for making their system a practicable one. Nor can there be any doubt that, the position having been realised, they have stirred themselves in earnest to do that which hitherto they neglected. The past summer has shown us, in a great measure, what the electric light is capable of doing, and how great are the facilities for adopting it at the shortest notice. We have only to turn back, in our mind's eye, to the display made at the recently closed Health Exhibition for ample evidence on this score.

Great, however, as are the capabilities of electricity for illuminating purposes, it will doubtless be many a long day before a sufficient amount of confidence is placed in it to warrant its general adoption. In the mean time, coal-gas will continue to fill with ever-increasing efficiency that sphere which it has so ably occupied for the greater part of the present century. Coal-gas is not only an illuminant, but it is also a proved source of energy; it is capable of driving powerful engines, of heating stoves and conservatories, and of being applied in a great number of other ways—ways in which electricity, notwithstanding all that certain learned professors may say to the contrary, has not yet been proved practicable. Electricity as a motive power still requires the feeding-bottle, nor are storage batteries far out of the cradle. Visions of their maturity loom before us, but they appear only in the dim, dim distance. The sooner their development is brought about the better. We should all benefit by the change, and even holders of gas shares might, by exhibiting becoming discretion, profit by it. For cooking purposes the application of electricity has scarcely been suggested, and there is every indication that, for this purpose alone, the consumption of gas will continue to increase with gigantic and constantly-augmented strides. The possibilities of the distant future, however, should not deter us from studying matters as they are, but should rather prompt us to become better acquainted with the present order of things, that we might be duly prepared to receive and welcome the change.

It is, then, with the conviction that gas is an old and faithful servant, but that the time will come when as an illuminant it will be superseded, that I venture to describe, first, the general principles involved in the manufacture of gas, and then one by one the many ways in which it is applied to satisfy our daily wants.

To commence with, a few historical remarks may not be out of place. The word "gas" is believed to have been derived from the Flemish "geest," a spirit (the term then generally applied to all things invisible). It was introduced by Van Helmont, a native of Brussels, born in 1577, who, in one of his experiments, burnt seventy-one pounds of charcoal, which yielded but one pound of ashes, and he concluded that the other seventy pounds served to form a "spirit," which he found to differ entirely from atmospheric air.

Very little, however, was derived from this, so far as the discovery of coal-gas and its properties are concerned. "Burning fountains, arising from inflammable gas issuing from the earth, have existed from remote ages, and, being attributed to supernatural agency, they were worshipped as emblems of the Deity." Records are also left of springs of "boyling water" that "did burn like oyle;" but perhaps the most interesting is the account of the discoveries and experiments of the Rev. Dr. John Clayton, who, towards, the close of the seventeenth century, had his attention drawn to one of these burning springs. It is stated that, "having caused a hole to be dug, on a candle being put down into the hole, the air catched fire, and continued burning." Dr. Clayton's interest was evidently excited, for he says, "I got some coal and distilled it in a retort in an open fire. At first there came over only phlegm" (steam), "afterwards a black oil, and then likewise a spirit" (gas) "arose, which I could in no ways condense, but it forced my lute, and on coming close thereto to repair it I observed that the spirit which issued out caught fire at the flame of the candle, and continued burning with violence as it issued out in a stream, which I blew out and lighted alternately several times. I then filled a good many bladders therewith, and might have filled an inconceivable

number more, for the spirit continued to rise for several hours and filled the bladders almost as fast as a man could have blown them with his mouth, and yet the quantity of coals was inconsiderable. I kept this spirit in the bladders a considerable time, and endeavoured several ways to condense it, but in vain, and, when I had a mind to divert strangers or friends, I have frequently taken one of the bladders and pricked a hole therein with a pin, and, compressing gently the bladder near the flame of a candle till it once took fire, it would then continue flaming till all the spirit was compressed out of the bladder, which was the more surprising because no one could discern any difference between those bladders and those that are filled with common air." In 1733 an interesting communication was made to the Royal Society by Sir James Lowther on the inflammable air issuing from the shaft of a coal-mine near Whitehaven. "The workmen were surprised, on sinking to a depth of forty-two fathoms, to find a rush of air taking place, which caught fire from the flame of a candle, and burnt with great intensity, making a blaze about 3 feet in diameter and 6 feet high. . . . . At length the heat communicated by the flame was found to be very inconvenient, as it warmed the pit to a high degree, and it was necessary to have recourse to water in order to extinguish it. . . . . The part of the pit at which the gas escaped was afterwards securely walled off, and a tube about 2 inches in diameter extended up the shaft to a height of 12 feet above the surface of the ground. Through this tube the gas was allowed to escape into the open air, which it continued to do in undiminished quantity for several years. Many observations and experiments were made on the gas which was thus discharged from the extremity of the tube." One of the fathers of modern chemistry, Dr. Priestley published in 1790 his "Experiments and Observations of different Kinds of Air," in which he says, "There are different kinds of inflammable air, as has been observed by most persons who have made experiments with air. That which is commonly observed is, that some of them burn with a flame which may be called a 'lambent flame,' sometimes blue, sometimes yellow, and sometimes white, like the flame from wood or coal, or a common fire. . . . . It is observable that when wood is heated in an earthen retort the first portion" (of inflammable air) "burns with a lambent white flame, like that from burning wood in an open fire." This brings us very near to the introduction of gas for illuminating purposes, for it is recorded that Mr. William Murdoch, an engineer of Redruth, in 1792 actually lighted his own house and office with gas derived from coal distilled in iron retorts, the gas being conveyed through tinned iron and copper tubes to a distance of seventy feet.

(To be continued.)

Some idea of the amount of engineering employment afforded by brewing trades may be gathered from the following statistics:—England is at the head of all beer-producing countries with 27,000 breweries, and a product of 990,000,000 gallons annually; while Germany, with 25,000 breweries, makes 900,000,000 gallons yearly. The United States, with only 3,000 breweries, makes about 600,000,000 gallons per annum. Then comes France, with 3,000 breweries, and a production of 157,500,000 gallons; and Austria and Hungary, with 2,093 breweries, but a production of 280,000,000 gallons. Belgium has 1,250 breweries, which produced last year 210,250,000 gallons; Holland, 500 breweries, producing 34,000,000 gallons; Russia, 480 breweries, producing 8,000,000 gallons; Switzerland, 423 breweries, producing 13,500,000 gallons; Denmark, 250 breweries, producing 28,000,000 gallons; Sweden, 220 breweries, producing 21,000,000 gallons; and Italy, 150 breweries, producing only 4,000,000 gallons. Nearly 80,000 persons are engaged in brewing lager beer in the United States.

In Passu.

There is every prospect of next year's Exhibition being a great success. It is stated that the number of applications already sent in represent more than twice the available space.

There are rumours that the net proceeds of the Health Exhibition amount to something like £40,000.

For those who find pleasure in pomp and pageantry, the passage of the London Government Bill would be neither more nor less than a gigantic calamity; and, judging from the immense crowds of people who thronged to witness the Lord Mayor's Show on Monday, such people are wonderfully numerous.

The fine weather helped materially to swell the enormous multitude, which is conceded on all sides to have been the largest ever brought together in London. The general bearing of the sightseers was exceptionally good, and betokened considerable respect for the outgoing and incoming magnates. Of course, there was the usual exhibition of horseplay by such gentlemen as sweeps in uniform and coal-heavers in full canonicals.

The Lord Mayor succeeded in introducing an instructive element into the display, which made it more acceptable than one could have deemed possible. He has the satisfaction of knowing, too, that his efforts were highly appreciated. It is to be hoped that he will experience at least as peaceful and prosperous a term of office as was enjoyed by his predecessor.

From a paragraph which appears in another part of this page, it will be seen that Englishmen maintain the position of "the greatest beer-drinkers in the world," but, after all, they are probably wiser than other nations, if we may judge from the remarkable revelations made by Mr. W. Mattieu Williams in his articles on "Wine Cookery."

Reviews.

SOME BOOKS ON OUR TABLE.

Hygiene; a Manual of Personal and Public Health. By Arthur Newsholme, M.D. (London: Geo. Gill & Sons. 1884.)—This is a succinct Encyclopædia of Hygiene, from which details as to sanitary diet, clothing, and employment; the construction, drainage, and ventilation of houses; water supply; the prevention and cure of diseases; accidents and their treatment, &c., &c., may be found in abundance, and studied with profit by all who wish to be healthy and wise.

A New Method of Recording the Motions of the Soft Palate. By Harrison Allen, M.D. (Philadelphia: P. Blakiston & Co., 1884.)—By the aid of a copper wire rod passed up the nostril, so as to touch its anterior border, the free end of such rod impinging on a carbon-covered rotating cylinder, Dr. Allen has succeeded in graphically registering the movements of the soft palate, during the acts of swallowing, sneezing, coughing, the pronunciation of various vowels and consonants, and even sentences. The interest and importance of this, alike to the physiologist and the student of acoustics, cannot fail to be apparent.

Nerves and Nerve-Troubles. By J. MORTIMER GRANVILLE, M.D. (London: W. H. Allen & Co. 1884).—Dr. Mortimer Granville has written a little book which should be procured forthwith by everyone who has arrived at the years of discretion. In language as simple and perspicuous as it can be, he points out the nature and origin of so-called "nervous" disorders, and gives the soundest advice as to their treatment, and especially as to their prevention. The chapter on "What is 'a cold?'" will convey some novel information to the mass of those who read it.

The History and Mystery of Sacrifice. By ST. GEORGE ST. CLAIR, F.G.S. (Birmingham: Cornish Brothers.)—With a considerable portion of Mr. St. Clair's pamphlet, we are precluded from dealing here; referring as it does to a fundamental dogma of the Christian faith. We may, however, say that the part in which he deals with the origin of sacrifice possesses a considerable amount of interest from an Anthropological point of view, and may be read, not without profit, by many who will wholly refuse to follow the author in his inferences from it.

In the Watches of the Night. By MRS. HORACE DOBELL. Vol. IV. (London: Remington & Co. 1884.)—As we have spoken somewhat disparagingly of Mrs. Dobell's previous volumes, we may in fairness say that the poetical element is more conspicuous in her fourth one than in its predecessors. But why will she be so utterly depressing? The book before us is one long-drawn sob from beginning to end.

A Short Handbook of Natural History. (Charles G. R. Griffith.)—This is really the expansion of a programme originally issued by the Chester Society of Natural Science giving details of the Classification of the Animal and Vegetable (with a glance at the Mineral) Kingdoms. It will be found handy by any one wishing to possess such a classification in a compendious and portable form.

A Manual of Bee-keeping. By JOHN HUNTER. Fourth Edition. (London: W. H. Allen & Co. 1884.)—It seems but as yesterday that the barbarous fashion of ruthlessly suffocating the busy little inhabitants of our hives, for the purpose of obtaining their honey, prevailed throughout the length and breadth of the land; yet now, the ancient straw "skep" only lingers among a very few old-world, benighted cottagers. How pleasant, profitable, and instructive bee-keeping on the modern system is, let all who practise it testify; and assuredly no better guide to its mysteries could be found than the ex-Honorary Secretary of the British Bee-keepers' Association. Mr. Hunter's is a book to make an Apiarian of the veriest urban dweller; and if bees could be kept in back-yards, no doubt its perusal would have the effect of adding wooden hives to other less pleasing objects which form the landscape visible from the windows in rear of London houses.

A Few Remarks on Railway Permanent Way. By CLEMENT E. STRETTON, C.E. (Leicester: The Author.)—Mr. Stretton points out the defective condition of a good deal of our permanent way, and makes very practical suggestions for its improvement. Among other illustrations appears one (from a photograph) of the awful accident which occurred at Huystetten, on Sept. 3, 1882, through the failure of the permanent way and the "spreading" of the rails.

The Queen and her Relations. (London: H. G. Davies.)—Those loyal subjects who may feel an interest in tracing the descent of her Majesty from Alfred the Great and William the Conqueror, or who are desirous of possessing a list of all the descendants of poor old mad George III., can do so by reference to the compendious little chart whose title heads this notice.

Competitive Examination Papers in Arithmetic. By N. C. POTTER. (London: Moffatt & Paige.)—Mr. Potter's series of questions seem well-selected and carefully graduated, involving tests of gradually increasing difficulty. Any student who can work all his examples through, may go with a light heart into the presence of an examiner.

The Social Emancipation of the Gipsies, by JAMES SIMSON. (London: Baillière, Tyndall, & Cox. 1884.)—We have tried very hard to understand this queer little pamphlet; we fear, however, with but scant success. Its author seems to rank among the great unappreciated, and is irate seemingly with the English press for its failure to estimate the value of his conclusions that John Bunyan was a gipsy, and that Mrs. Carlyle had gipsy blood in her. Really, though, Bunyan is mixed up in such a way with snakes swallowing their young alive for protection, &c., that we speak with some diffidence.

Slyboots. By BEATA FRANCIS. (London: Hodder & Stoughton. 1884.)—All little people who make pets of domestic animals will be delighted with Miss Francis's "Slyboots." The wily artifices of Slyboots to secure a supper for his wife and family form the groundwork of the introductory chapter, the succeeding ones being devoted to the history and mystery, manners and customs, excellencies and failings of the whole of the livestock of Mrs. Jerkins's farm. The moral of these various stories, without being obtruded, is rendered obvious enough. The repentance of Miss Rosytoes for the troubles which her vanity brought upon her lover, and the tragic ending of the close friendship between Sandy the cat and Johnny the pigeon will be among the most attractive parts of the story for the young folks.

The Adventures of Oliver Twist, by CHARLES DICKENS. (London: W. Kent & Co.)—A cheap and daintily-printed edition of our great English novelist's terrible and powerful story. The very thing to take on a journey, as it may be carried easily in the pocket.

Aunt Judy's Annual Volume. Edited by H. K. F. GATTY. (London: Bemrose & Sons. 1884.)—Biography and botany, songs, poetry, tales, essays, and sketches, as bright and fresh as ever, will cause dear "Aunt Judy" to be as heartily welcomed as of yore in the nursery and playroom. Here is a perfectly delightful present for a good boy or girl.

We have also on our table, from Messrs. Cassell & Co., *European Butterflies and Moths*, *History of the Franco-German War*, *The Library of English Literature*, *The Countries of the World*, *Cassell's Household Guide*, *Cassell's Popular Gardening*, *The Book of Health*, *Old and New Edinburgh* (very interesting, and modelled on their well-known *Old and New London*), *Cassell's Illustrated Almanack for* 1885, and *Recent British Battles*. Also *The American Naturalist*, *Science*, *Ciel et Terre*, *The Journal of Botany*, *Mottoes and Motives*, *On the Manufacture of Gas from Oil*, *The Medical Press and Circular*, *The Practical Confectioner*, *The English Household Magazine*, *The Kansas City Review of Science and Industry*, *Our Monthly*, *The Life-Boat*, *The Hindu Excelsior Magazine*, *Bradstreet's*, *Society*, *The Tricyclist*, and *The Gazette of the Travelling Tax Abolition Committee.*

ERRATA.—In "Graphical Projection of an Eclipse of the Moon," on p. 383, col. 2, line 3, for "5° 9′ 17″ ·1" read "59′ 17″ ·1." In the same column, lines 19 and 15 from the bottom, a comma should have been inserted between the letters "E" and "K." In line ten from bottom, for "R T" read "R I." In line 4 from bottom a comma should have been placed between "S" and "T." In letter 1500, line 15, "midnight" should be "midday." In p. 382, col. 2, second line from bottom, for "less" read "greater." In reply to W. Cave Thomas, p. 392, col. 2, "Nood" should be "Rood."

Miscellanea.

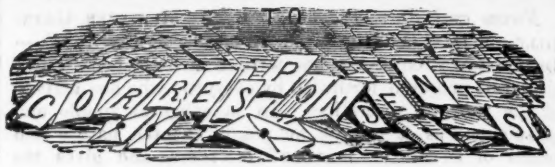
As a contribution towards the question of post-mortem attitudes, a correspondent sends us the following extract from the evidence given at the inquest on the body of Mrs. Ridley, who cut the throats of herself and her children at Newcastle, on Oct. 31:—"The mother was in a half-standing position, and leaning partly against a cupboard and the wall. Her feet were towards the parlour, and her hands were held up before her face, as if, after she had cut her throat, death had intervened so quickly that she had immediately become rigid."

M. Ch. Mano brought before the Académie des Sciences at the séance of September 29, the results of a careful survey of the section of the Cordilleras traversing the Isthmus of Panama. He is satisfied that the northern continuation of the Andes system belongs to a more recent geological epoch than that of the Syenites and serpentines of Choco and Antioquia, whence it appears to branch off. It is also later than the porphyries of the Costa Rica coast range, which belong to the system of the Rocky Mountains, stretching thence northwards to the Polar Sea.

The *Athenæum*, from which we copied last week a note with reference to Dickens's connection with the *Daily News*, says:—"The volume in the possession of the proprietors of the *Daily News* containing entries made whilst Dickens was editor of that journal, is, we understand, of rather too technical a character to have much interest for the general public, excepting a few passages. We were in error last week in supposing the existence of such a volume to be known to the editors of Dickens's correspondence. We may further add that Mr. Dudley Costello, who made the entries in the volume in question, was foreign editor, Mr. Wills being sub-editor."

According to a foreign paper the international steel railmakers' combination is arranged upon the following understanding, viz.:—That English makers shall receive 65 per cent. by weight of all rail orders, Germany 27 per cent., and Belgium 8 per cent. Indian orders are specially reserved for the English makers. A contract for 11,000 tons for Italy has been recently allotted to the Bochum and Phœnix companies, near Dusseldorf. Consumers of rails may, observes the *Engineer* (and we are at one with our contemporary on this point), flatter themselves that they determine where their orders are placed. If so they are simply deluding themselves. It is all arranged for them by the railmakers themselves, and they must submit to their fates unless they are prepared to accept other than the lowest tender. It will be interesting to observe how long this artificial state of things will last.

The Polytechnic Institute.—A series of Winter Saturday Evening Concerts has been arranged in connection with the above-named Institute, which, judging from the large and appreciative audience in attendance on Saturday last, bids fair to prove extremely successful. These concerts are given in development of Mr. Quintin Hogg's scheme of making instruction attractive by running it hand-in-hand with pleasure; and much of their success is no doubt due to the thoroughly liberal spirit of that gentleman (who, by the way, is also Liberal in politics, and will stand as a Parliamentary candidate for Westminster at the first opportunity). Mr. Hogg readily perceived that to make the Institute successful as a medium of education, he must first of all ensure its *popularity*, and towards that end no expense or trouble has been spared. Not the least interesting feature of these concerts is the manifest feeling of good-fellowship evinced by all who "assist" at them. Most people have at one time or another been present at one of those so-called "grand," but depressing, evening concerts which are generally promoted by local busybodies, ostensibly for some good purpose, but really to display their own importance; and doubtless they retain painful recollections of the barely-furnished building, the stony stare of superiority bestowed by the five-shilling "exclusives" on the less-fortunate one-shilling visitors, the "wooden" manner in which the *artistes* engaged went through their performances, and the self-complacent air of having performed a duty which seemed to pervade the audience when the programme had dragged itself to a close. No greater contrast to this sort of thing could be found than is afforded by the concerts at the "Poly." The members seem to vie with each other in their endeavours to promote the comfort of their visitors; and this desire cannot but be conducive to the success of the entertainments, which, however, should command extensive support on their artistic merits alone. Last Saturday's programme was extremely well chosen, and its items rendered by the performers (who are all either members of the Institute or their friends) in a very creditable manner; special praise, perhaps, being due to the military band of the Institute, which, under the direction of Mr. T. Scamell, played several selections during the evening.



"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

All Remittances, Cheques, and Post Office Orders should be made payable to Messrs. Wyman & Sons.

The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

DUALITY OF THE BRAIN.

[1502]—The duality of the brain is a familiar theory. I have never before heard that the left brain was supposed to be the chief seat of intellect. But I have always felt sure that it was so in my own case. My left side is more than usually inferior, both in power and in prompt response to the semi-conscious impulses of the mind. For thirty years I was subject to frequent and severe neuralgic headaches, nineteen in twenty of which originated in, or were generally confined to, the left half of the head. But more than this. When sleepless or fevered by intellectual labour, I *feel* the whole brain, feel conscious of its existence, and in some sense its working. In a lesser degree I am almost always conscious of the left brain, but not of the right; conscious not exactly of its working, but of its presence, as a sort of light weight inside the head. Indeed, in quiet fancy or reverie I might well suppose that the right half of the head was empty, and the left filled. And this difference almost always increases with prolonged brain work, till it reaches the stage at which the whole brain is consciously oppressed and uncomfortable.

Of the dual action of the mind, I have also had at times very curious experience. A keen and eager partisan, strongly convinced of the truth of the doctrines I advocate, there is frequently a sort of contradictory intelligence with me, saying to me: "You know that thought is exaggerated; the other cannot be true; so many of the wisest men, you know, differ from you about this third point." Yet my conviction of their truth remains. I should say that the left brain, the working one, was derived from one parent the other—the critical, inactive, correcting brain—from the other. I can well understand the demon of Socrates. It would need but a little exaggeration of my own consciousness to make the correcting intelligence a separate, external personality.

Still more curious is the fact that occasionally for a moment, in waking from sleep—rather, perhaps, before waking—I feel myself two persons—never more; which coalesce, as by a flash of lightning, before I become even half-conscious. This experience has not been frequent; but has occurred often enough to impress itself as a fact upon my memory.

Finally, since a severe illness, which slightly affected the brain, I have been far less conscious of any of these abnormal phenomena; but the only power that has deserted me, and that gradually, is that of writing poetry. Verse I can still manufacture after a fashion, but can never sustain the intellectual strain and absorption necessary to earnest poetry for more than a couple of stanzas at a time. It would seem as if that illness had equalised more or less the power and activity of the two brains. Q. X. V.

[1503]—I have read with great interest your series of papers on "Our Two Brains." Possibly the following experience may be of some interest to you, and you might also be able to offer an explanation of them. When being shown into a strange room, which I am positively certain I never entered before, it often seems strangely familiar to me, and I am dimly conscious of having been there on some former occasion. Often in society I seem to have a vague consciousness that I have listened to the same conversation before. This sensation sometimes haunts me, even in the most ordinary affairs of life, but it is only when my attention is roused by something uncommon happening that I feel it most strongly. Somehow or other I cannot suppose that I have fore-knowledge

of what was going to happen, as I seem invariably to forget it, and it is only with the occurrence of the event that the impression returns. Mr. Rudd, in letter 1181, in KNOWLEDGE of April 11, suggests that one hemisphere is asleep while the other is awake. Admitting this, we have a very plausible explanation. The faint impression passing through the single brain, and immediately afterwards the vivid impression being received by the two hemispheres, might cause the effect in question. But of this you are more able to judge than I.—I am, &c.,

W. S.

[The experience of "W. S." must be a familiar one to almost everybody. So strong, on occasion, has been my own impression that I was witnessing the repetition of a scene, or of a conversation which had previously occurred at a remote date, that I have seemed to know what was coming next.—ED.]

[1504]—I have been much interested in your articles on "Our Two Brains." While reading I thought of what occurred under my own eye a short time since. A young girl, about 13, had an attack of hysteria, which lasted, more or less, for three weeks. At times she would be for twenty-four hours in a state so far unconscious as not to recognise her friends. While in these conditions she would talk to any one of us quite reasonably, but persisted in calling us by wrong names. I was called in anything but glowing terms, and was always looked upon as a person representing her schoolmistress. Whenever I went in and saw her in this state, which was frequent, I was without exception called by the same name. I was frequently there when she was roused from her unconsciousness when I was at once addressed as Mr. T——. This appears to be a satisfactory answer to the question, have we two brains? When in a state of perfect consciousness, she would be wholly ignorant of what she had been saying during her former state; but when returning she would answer any question put to her when in a previous state without fail.

While writing the above, I will relate what occurred to myself to-night. After tea I fell asleep, and while in that state I felt an inclination to awaken myself—a feeling somewhat akin to the nightmare. I succeeded, and experienced a violent palpitation of the heart for about fifteen minutes afterwards. Could any of our readers kindly explain? J. W. T.

FEMALE BRAIN-POWER.

[1505]—In 1444 Mr. W. H. Jones suggests that women are inferior because they have been long uncultured, and that now that things are different they may improve up to male level. This is surely a fallacy; it is treating women as if they were a separate race, like negroes, &c. Every woman must have a father; what reason can be given for her inheriting less of his natural and acquired capacity than her brothers? What is true is, that the cultivation of women will probably raise the level of all their children. But then, the boys improving *pari passu* with the girls, and having already a great start (*ex-hyp.*), the girls will never get up with them. HALLYARDS.

ECONOMY.

[1506]—One of the wonders of the present age is "How do most people manage to live?" We do not refer to the large percentage of those who, without any ostensible means of obtaining an independent livelihood, are thrown for support upon the kindness of their friends or relations, and who continue through life to draw from that source what may be necessary to make up the deficiency in their own incomes.

These are *dependent*, but their friends are satisfied that it should be so, and cheerfully contribute to their support, so that they are somehow always enabled to make both ends meet.

The class to which we allude as the majority is that comprised of people who may be considered to have done as well as they and their friends could naturally have expected, and who have certainly reached as high a social status as they are ever likely to attain to. These are in receipt of a settled income, uncertain, perhaps, but, for the moment tangible, and it is at first sight surprising that such apparently ample means should fall to the lot of so many, and still more so that they should prove insufficient to meet the demands which are made upon them by the usages of modern society. As a rule, the expenditure appears to be quite up to, if not in excess of, the income, instead of being—were the dictates of common sense only followed—somewhat or even considerably under it, in order that provision might be made for the proverbial rainy day or the age of the "sere and yellow."

Many a man at the end of the year is surprised at the amount he has got through, and the little he has to show for it. Even taking those who carefully avoid extravagance or the indulgence of frivolous or expensive tastes or habits, it is the actual *necessary* expenditure every day that runs away with the money, and it is necessary because we are all obliged to conform to certain rules and regulations which our position in society exacts, and which it is high time some stand were made against, were it only to avoid a state of universal bankruptcy.

We are convinced that the greater number of civilised beings, no matter what their position, live quite up to, if not beyond, their means. They are brought up with tastes and ideas frequently quite unwarranted by their expectations.

Parents wish their children to have more than they had themselves, instead of instilling into them, when young, the principles of self-denial and prudence. When they grow up they are accustomed to regard as necessaries what their fathers looked upon as luxuries, and the means which ought in their position to prove ample, are not sufficient to cover their increased expenditure.

Society is hard upon those even in the middle class who are not well dressed, whose table is homely, and who take no part in the amusements which, though innocent enough in themselves, are either expensive or occupy time which might be much more profitably employed in some remunerative occupation, or, what in the end amounts to the same thing, the acquisition of knowledge.

Against the growing evil of impecuniosity, with which there is no doubt we are all afflicted (excepting those who are born with silver spoons in their mouths), we know of only one remedy, but it is one that is open to all, and has been proved to be effective by many. "Time is money."

We want money—very badly some of us—and yet we waste and spend it in the shape of time, throwing away the precious hours which, if well employed, would ere this have afforded us a mine of wealth.

No one can afford or has any right to be idle, and were this generally acknowledged and acted upon, a certain stigma would attach to those who "lost their time" in doing nothing. Moderate recreation and the duties of home are in themselves healthy and necessary employments, and we refer only to those who are needlessly and absolutely *idle*.

Each one can tell the amount of *idle* time he has at his disposal. Let him employ this as we have already suggested, in *working* or *learning* or *teaching*, and he will find that even if his income does not perceptibly increase, his expenditure will certainly diminish, and he will ere long learn to value at its full the advantage and comfort of true economy. N.

[I print this letter (which reaches me all the way from South America) as a contribution to a somewhat important problem in sociology.—ED.]

FIGURE PUZZLE.

[1507]—After the trouble caused you by the appearance of Puzzle 1398, I hesitate again to refer to it; but I may be allowed to point out that the peculiarity shown was due to the position of the number 7 in the decimal system. The same peculiarity exists in regard to the fraction $\frac{1}{13}$, as shown below, in what may be termed the converse of Puzzle 1,398, thus:—

076923 = $\frac{1}{13}$ in decimal form.
769230 = 10 times the above.
692307 = 9 " "
923076 = 12 " "
230769 = 3 " "
307692 = 4 " "

J. C.

THE MOUTH ORGANS OF THE DIPTERA.

[1508]—A friend has recently brought to my notice a copy of KNOWLEDGE containing a paper by Mr. H. J. Slack, on pages 312–13 of the present volume, on the "Mouth Organs of the Diptera," which, among other matter connected with the subject, treats in a general way of the teeth of the blow-fly.

Having paid considerable attention to these particular organs in the Diptera, perhaps you will permit me to fully confirm what Mr. Slack has stated with regard to the dentition of the blow-fly, and to add that, in addition to the genus Musca, these organs are to be found in many widely divergent species of the Diptera. These organs are not always of the simple type exhibited in *Musca lardaria*, but that by gradations they can be traced to most divergent forms.

I am at present engaged in contributing a series of short articles, accompanied with illustrations, on this subject to the pages of *Science Gossip*, which will, I think, show pretty conclusively there is a wide field for research in this direction, and that the knowledge thus obtained will shed a new light upon a subject which has as yet been comparatively unworked.

The number of teeth, their form, and manner of grouping, point

in a very remarkable manner to the truthfulness of development; and perhaps, if agreeable to you, sir, I may, when my experience is further extended, offer the readers of KNOWLEDGE a few remarks on this very interesting subject.—I am, sir, yours faithfully,

W. H. HARRIS.

SUPERSTITIONS.

[1509]—Many years ago, when a very young girl, I was taken to the bedside of an old lady, a connection by marriage of my family, who had shortly before been seized with a slight attack of paralysis. She was propped up in bed, and in a kind of semi-conscious condition—that is to say, I remember doubting at the time whether she completely recognised me, though she had known me from my earliest childhood. Her bed faced the window, before which was the usual toilet-table and mirror. To my astonishment, the latter piece of furniture was covered with a large white cloth. On my inquiring the reason of this I was told by the attendant that it should always be done in the case of a sick or dying person; it was unlucky for them to see themselves in a looking-glass. The invalid's sister seemed also to see it in this light. Is this idea an universal one with the lower orders in England, or is it peculiar to the Midland counties, where this occurred? COSMOPOLITAN.

PRIMARY COLOURS AND PRIMITIVE COLOURS.

[1510]—After reading the articles Nos. 1326, 1388, and 1433 in KNOWLEDGE, it struck me that we are apt to confound the word *primary* with *primitive*, when speaking of colours, and that the former should be used to denote the tints which the atmosphere produces in a ray of solar light in its passage to us; as for example, under certain conditions when the rays of the sun strike upon a waterfall we see a most brilliant rainbow between ourselves and the cascade, if we move to one side or the other, the different colours seem to us to change their places as we change our position with regard to the ray of light.

The word *primitive* as applied to colours, does not in this case appear to be appropriate, this expression seems as if it should rather be used when speaking of the three principal colours used in painting, viz., red, blue, and yellow, whereof other colours can be composed.

Being at the time absent from home, I had no works of reference with me, and the matter had almost faded from my mind, when an accidental conversation recalled it. At the first opportunity I consulted Brande's "Dictionary of Science, Literature, and Art," to ascertain his opinion on the subject. He seems to have come to a similar conclusion as myself, though couched in scientific language.

Red, blue, and yellow may be called *primitive* colours in another sense also, for they are those which are not only preferred, but we may say exclusively adopted, by *primitive* peoples—that is to say, by certain races in Asia and in Europe, who, living in remote and almost inaccessible districts, have remained very conservative in their manners and customs. The following instances have come under my own observation:—

In the Spiti Valley, in the Himalayas, and in Ludakh, or Western Tibet (both of these from their position and climatic conditions shut off from the outer world during nearly half the year), the women use these three colours in their dress and ornaments. The upper garment of those of the former place is of dark blue cloth; red and yellow are introduced in the trimming, the latter very sparingly. The ornaments of both these peoples are composed of red cornelian, coral, rough turquoises, and amber, but some of the richer women in Ludakh introduce small squares of green cloth alternately with red; on the inner side of the square of sheepskin with which they cover their shoulders both in summer and winter; and when in gala-dress, they not unfrequently stick the small gold-coloured seeds of some plant on their faces, at distances about half-an-inch apart, which gives a singular effect to their countenances.

When in India I observed that though the natives seem to have an instinctive feeling for harmony of colour, as we see by the carpets they produce, yet many appear to be unable to distinguish between light and dark shades of the same colour. I have often been assured by them that two pieces of brown woollen material were identical when there was really many shades of difference between them.

To turn to Europe. The women of some parts of Albania execute embroidery in geometric patterns on white linen for the adornment of their own under-garments. Even tiny girls of four or five are adepts at this work. As far as I saw, they used cotton thread of these three colours only. They have no pattern traced on the material; it is all done out of their own inner consciousness. So also in northern lands. Races whom the position of their country has shut off from communication with other peoples use them likewise. In the museum at Bergen, in Norway, are some specimens of embroidery, perhaps a century or two old, which resemble, both in character and colouring, the handiwork of the Albanian peasant girls. COSMOPOLITAN.

[There can be no objection to "Cosmopolitan" using the word "primitive" in the sense in which it is employed above—that red, blue, and yellow are primary colours, though, it is a grave error to suppose. Crimson-lake, gamboge, and Prussian blue (as Rood points out) suffice approximately to represent all colours *in painting*, though blue light and yellow light do not produce green light, but white, and the mixture of red and green light produces yellow. In the present state of our knowledge all evidence points to the fact that the real primary colours are red, green, and violet. —ED.]

LETTERS RECEIVED AND SHORT ANSWERS.

HENRY PALMER. Thanks. You will see that it has been utilised—E. L. G., WM. ASTON, J. H., ALFRED BUSS, J. T. WOOD, J. GREEVEZ FISHER, H. ASKEY, M.A., W. TOWLER, J. E. GORE, and W. E. SADE write to say that the "Figure Puzzle" in letter 1490 is nothing but a magic square. Mr. Towler adds a long extract from some article or essay detailing how the Egyptians and Pythagoreans held the magic square in great veneration, dedicating it to the then known seven planets, and engraving it on a plate of metal "in sympathy with the planet." (I wonder how they managed this with Mercury?) The square thus dedicated was enclosed in a regular polygon inscribed in a circle, divided into as many equal parts as there were units in the sides of the square, with the names of the angles of the planet (?) and the signs of the zodiac written on the void spaces between the polygon and the circumference. No single correspondent, however, attempts to show the connection between the figures in the (quite obvious) "Magic Square," and the tremendous magical power attributed to them, which I understood to be the specific subject of the question of "Lover of Things Occult."—H. W. WILSON (The Lyceum, Cornholme, Todmorden). For the *n*th time Mr. Proctor has entirely ceased to lecture. See p. 62 of the current volume of KNOWLEDGE, and the paragraph (in capital letters) which concludes the heading to the correspondence column.—SAMUEL KINNS. Forwarded to the conductor of this Journal.—W. S. B. wants to know how, in the "Game of Fifteen," to obtain the consecutive order when, after arranging three rows, the last row reads 13, 14, 15?—JAS. FRASER. Your object-glass is certainly not achromatic; and hence not worth spending any more money upon. Even, however, assuming that it did transmit a colourless image, the eye-tube of an ordinary terrestrial eye-piece would give far too low a power for the observation of Saturn's rings. These might be seen—or rather perceived—as a single ring with a first-class two-inch objective and a power of 80. You have been trying to view them with a very indifferent one on a magnification of perhaps 8 or 10!—NEO. No. The day can *not* by any possibility have been lengthened since Neolithic times to an extent which would have caused a difference of 6° in the point of sunrise; in fact it is a moot question whether it has ever lengthened at all. Moreover, the length of the day has nothing to do with the point of sunrise, the only operative factor in changing which is the alteration in the obliquity of the eclipse. Under any circumstances, however, this could merely shift such point a little over 2° in 9,000 years, and this, I fear, will not help you much. You must address any order for KNOWLEDGE to the *publishers*, and not to me. You state that you "enclose stamps," which you do not. —F. W. RUDLER. Received with thanks.—HALLYARDS. Never mind the phrase. *Ars probat artificem*, and your fellow readers will judge you by what appears in print from your pen. You are too flattering. In connection with your American friend, I may quote a dictum of a fellow-countryman of his, apropos of a man who had made a certain statement in his presence, "I don't say he's a liar, but if I met him walking down the Broadway of my naytyve city of New York between Ananias and Sapphira I should say that they were an uncommon nice family party!"—A. K., ALFRED BUSS, and W. MATHIAS further add to the noble army of solvers of the "Magic Square" in letter 1,490; Mr. Mathias pointing out in addition that the numbers, 1, 3, 5, 7, 9, 11, and 17, which occur frequently, are (in connection with days) "turning points in all, or most, human diseases;" whence the superstition of this occult power may have had its origin. He also suggests the following problem. Arrange the numbers from 1 to 16 in a square, "so that the sum of any row, column, or square of four numbers may be 34."—JOHN G. RICHARDSON forwards his subscription for one year to the *Editor*, who has had in turn to send it back to the Publishers, thereby causing wholly needless delay. I am almost tired of reiterating that I have nothing, proximately or remotely, to do with the business management of KNOWLEDGE, and that it is not I, but the Messrs. Wyman, who sell it. The other matter in your letter shall have immediate attention.—GEO. LUFF. Stamps sent on to Publishers, to whom you ought to have addressed them, and not to me.

Our Inventors' Column.

So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.

THE "IDEAL" LAMP.

Although gas is now so general, and although gas is threatened by the electric light, the lamp still holds its ground, and remains the object of much inventive ingenuity. One of the leading inventors in this line is Mr. C. F. A. Hinrich, of New York; and at the offices of Messrs. Zimmerman & Co., of 57, Farringdon-street, London, may now be seen several remarkable inventions in the form of new lamps. One of these is known as the "Ideal," and is constructed wholly of nickel-plated brass, and any quality of kerosine may be used without the slightest danger of an explosion; the oil also is kept constantly cool by the draught of cold air which is continually circulating around the well. No shade or chimney is required, but for the protection of the eyes while reading a shade such as used on gas can be utilised. Whether the lamp is turned at its full height or very low it will burn without smoke or odour. In fact, it replaces gas at a low cost. The combustion is created by a fan attached to a clock in the body of the lamp, made of the best steel with hard brass mountings, perfectly noiseless, and wound by turning a rosette on the side to a full stop, when they will run until the oil in the lamp is consumed, or about ten hours. The clockwork is made very heavy and open so that anyone can clean it without taking it apart. The light is clear and steady, without the flickering or tremulous shadow of gas; it is bleached almost white by the constant supply of air, without having any injurious qualities.

THE NEW PATENT "CARRAGO" STEEL NOSE-BAND.

What is claimed to be a perfect cure for restive horses has at last been found. Mr. Richard Winder, of Farningham, Kent, has invented what is called the New Patent "Carrago" Steel Nose-Band, which supersedes the bit, and is said to be greatly superior thereto. It is fixed about two inches below the place where the nose-bone separates from the skull proper, and, as a further check, the "Carrago" should show just above the mouth. The secret of the power which can be exercised over the horse by the "Carrago" lies in the fact that the nose and cheek-bones are very sensitive to pressure. This pressure is not exerted when the animal is going quietly, and only slightly to guide him. An india-rubber pad inside the curved part protects the nose from chafing. One of the advantages of this appliance is that its use entirely supersedes that of the bit, or a mouthful of bits, and these alone are a great and prolific source of irritation to all horses. Another advantage claimed by the inventor is that the "Carrago" simply lies upon the nose-bone, and weighs only some eight ounces; as long as the horse is driven by a light hand, it is practically unfelt, and only becomes severe when the horse needs correction or coercion. The guiding is performed by the thumb and finger only, so sensitive is any horse to the side pressure. It is believed that the use of this invention would prevent many accidents which the ordinary bit and reins are powerless to avert.

THE PREVENTION OF "BLOCKING" IN PIANOFORTE ACTIONS.

Nearly every advanced instrumentalist on the piano must at times have suffered extreme annoyance from what is technically known as "blocking"—*i.e.*, the failure of the hammer to return consequent on the repeating action being in some way defective. Musicians who suffer from this cause will be interested to know that Mr. James Semple, of North-park-terrace, Hillhead, Glasgow, claims, by the improvements he has effected in pianoforte actions, to effectually and completely obviate this source of annoyance by securing a perfect repeating action, combined with a complete check action which prevents any vibration or "blocking" of the hammer.

TOY FOOTBALL.

The inventor of a new game, or even a good modification of an old one, well merits the gratitude of all his fellow-creatures in these high-pressure, overwrought days. What appears likely to prove a highly popular game for long winter evenings has been just invented by Messrs. Pomfret & Fox, of 54, Church-street, Preston. The game in question is an ingenious application of football for indoor recreation. Football pure and simple is a very manly and hardy sport to which many object, but "parlour" football, as will be seen, is free from fault of any kind, and deserves the widest encouragement by reason of its ingenuity and ever-varying interest. The game is arranged to be played by two persons on a board divided into 208 squares. Each player has 11 toy men, consisting of 5 forwards, 3 half-backs, 2 backs, and a goal-keeper. The mimic men can be moved forwards, backwards, or sideway, either in a square or diagonally, under certain rules; for instance, the goal-keeper is allowed to move any number and to any square between his goal-posts, and can kick out from one to six squares, but can only retreat one square at a move, except in a "goal-kick," when he must kick 6 squares in any direction, and must return at once to his goal. The ball is pushed or "kicked" from square to square by the toy men according to the rules, and is put in motion at the commencement by the centre forward. The object is to work the ball from the centre and get it between the opposite goal-posts. There are "corner-kicks," "throws-in," "free kicks," and "goal-kick," but that bone of contention—the off-side rule—is not recognised. The duration of the game is thirty minutes each way, but this time can be shortened or lengthened as convenience demands; when "half-time" is called, no matter where the ball is, ends must be changed, and the "kick-off" again taken from the centre.

A NEW BLIND-PULLEY.

Pulling down the blind often tries the temper, and is an operation that should be performed by automatic means on touching some simple contrivance for the purpose. Messrs. George Salter & Co., of West Bromwich, have improved a blind-pulley of theirs, which is now practically perfected. This arrangement is self-acting; the movement being regulated by a steel spring enclosed in the barrel, which adapts itself to the cord as it lengthens or shortens with the changes of the weather. The strain on the cord and the roller is thus very much reduced, and the risk of a falling blind is almost entirely obviated. In construction, the article is very strong and durable, and it has an elegant appearance, thus rendering it suitable for any class of room. This pulley is also made in iron, and in larger sizes for out-door use, such as for green-house blinds, &c.

A NEW SHOE-TIE.

Englishwomen have not been remarkable for care and taste in foot gear, but of late an improvement has been evident in that respect, and ugly shoes and clumsy boots are now disappearing rapidly in favour of more artistic patterns. Following out this phase of fashion, Messrs. G. Hoby & Co., of 4, Great Queen-street, Lincoln's-Inn Fields, have introduced an ingenious French invention for fastening shoe ties. The principle of the invention is a kind of spring clutch, the lower jaw of which is laid under the bow of the tie when the knot is made; the upper jaw then closes upon the bow, and the roughened edges of the clutch keep the lace from slipping or becoming untied. The appearance is highly ornamental, and its use would entirely remove the ugly look of many ordinary walking-shoes, without becoming in any way an obtrusive ornament.

A PATENT GREASE-TRAP.

Every householder who does not entirely ignore the kitchen and its many vital details, knows the troubles and sanitary evils that arise out of the construction of most sinks and their drains. Messrs. J. and M. Craig, of the Hillhead and Perceton Fireclay Works, Hillhead and Long Park Sanitary Pottery, Kilmarnock, are now introducing a new patent grease-trap, which is in use at Balmoral Castle, and when fixed between the waste-pipe from a kitchen sink and the drain, entirely prevents the accumulation of grease in the drain and the consequent chocking of the pipes. This result is obtained by the use of a large central chamber or reservoir, in which the grease collects, and from which it may be removed as often as necessary without trouble. The same firm also manufacture enamelled sinks, which possess obvious merits of a sanitary character, besides their comfort and convenience.

IMPROVED FIRE-GRATES.

Grates and stoves have been, and are, the subject of a bewildering list of patents, good, bad, and indifferent. An invention, however, of Mr. John Bate, of Holborn-viaduct, E.C., machinery merchant, seems ingenious, and should certainly conduce to great convenience and economy of fuel. According to this invention, the fire-grate is divided by a grating or grated partition, so arranged as to cut off a hopper, or similar space or receptacle, preferably at the back or sides of the fire; and into this small coal, dust, cinders, or the like, are placed, whilst the main body of fuel is placed outside such partition or receptacle. This hopper-like space may occupy any portion of the whole, and may be open at bottom in some cases. The grate, moreover, may either be cast with such partition, or it may have guides to receive a loose partition.

Our Chess Column.

By Mephisto.

Game played Saturday, the 8th inst., in the match of Lancashire *v.* Yorkshire, at the Athenæum, Manchester.

French Defence.

White. Mr. R. K. Leather. (Liverpool.)	Black. Mr. R. M. Macmaster. (Bradford.)
1. P to K4	P to K3
2. P to Q4	P to Q4
3. Kt to QB3	Kt to KB3
4. P to K5 (*a*)	KKt to Q2
5. QKt to K2 (*b*)	P to QB4
6. P to B3	Kt to QB3
7. P to KB4	B to K2
8. Kt to B3	P to QKt4
9. B to K3	P to B5
10. Kt to Kt3	P to B4 (*c*)
11. P × P (en pas)	Kt × P
12. Kt to K5	Q to Kt3
13. B to K2	Castles
14. Castles	P to Kt5
15. Q to Q2	R to Kt sq.
16. B to B3	P to Kt3
17. K to R sq.	P to QR4
18. QR to Kt sq. (*d*)	Kt to Q2
19. KR to K sq. (*e*)	Kt (Q2) × Kt
20. BP × Kt	P × P
21. P × P	Q × R (*f*)
22. R × Q	R × R (ch)
23. B to Kt sq.	B to Q2
24. Q to QB2 (*g*)	KR to Kt sq.
25. Q to R4 (*h*)	Kt × KP
26. Q × RP	Kt to Q6
27. P to KR3	B to Q3 (*i*)

And Black won.

NOTES.

(*a*) The usual continuation is B to KKt5; the move of P to K5 at this stage deserves attention.

(*b*) Preparing to support his QP against P to QB4.

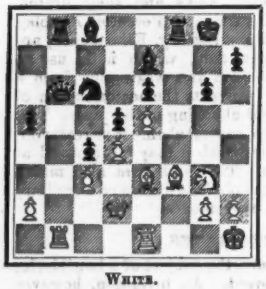
(*c*) Black ought to have further proceeded on the Q's side; this move injures Black's position by enabling White to occupy K5, and the KP is likewise weak.

(*d*) Kt × QBP would not have won the P, for after P × Kt, P to Q5 and P × Kt, the White P could not be defended for long. QR to B sq. would have been a better move, as it would have provided against any further proceedings on the Q side, and left White free to act against the weakened Black K.

(*e*) Here 19. P to B5 seemed a better move, for if KtP × P 20. B to R6, but now Black could give up the exchange and have two good Pawns, or he may likewise reply with QKtP × P.

(*f*) It is very difficult to judge when the exchange of the Q for the two Rooks is good or not. It is certain, however, that had Black retired his Q, White would soon have obtained the better game.

Black.



White.

(*g*) This is worse than useless, as it is clearly Black's intention to double his Rooks. It would have been better to play P to KR3 and K to R2 at once, or play Q to K3.

(*h*) A grave mistake, and at best an error of judgment, for instead of trying to win a P, White should have endeavoured to disengage his pieces.

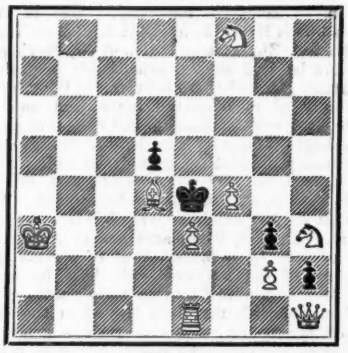
(*i*) Black has conducted this game with a sound judgment combined with a vigorous attack. The record is, unfortunately, incomplete. If now 28. K to R2, P to R4. 29. P to KR4, P to Kt4, and Black must win.

A highly interesting Chess match was played on the 8th inst. at Manchester, the contestants being 80 players of Lancashire *v.* 80 of Yorkshire. The Manchester and Liverpool Chess clubs contributed the majority of Lancashire players. Both these clubs are very strong, indeed, probably the two strongest provincial clubs in the kingdom. The best Liverpool players were Mr. A. Burn, Rev. J. Owen, Mr. S. Wellington, Mr. R. K. Leather, Mr. W. W. Rutherford Mr. A. Hoistendahl. The foremost amongst Manchester players were Messrs. H. Jones, J. Baddeley, A. Steinkuhler, T. von Zobern. These players were opposed respectively by Messrs. J. W. Young, J. Butler (Wakefield), C. G. Bennett, James Rayner, T. Y. Stokoe, E. R. Hussey (Leeds), F. F. Ayre, E. Freeborough (Hull), Rev. H. J. Huntsman (Sheffield), R. M. Macmaster (Bradford). There were 132 games played, the result being a victory for Lancashire by 74 games to 31, with 27 draws.

PROBLEM No. 135.

By H. F. L. Meyer.

Black.



White.

White to play and mate in three moves.

"Clarence" writes:—"I send you a problem composed by Herr Meyer, admittedly embodying two ideas, each separately claimed *as original* by Shinkman and Lloyd; the former anticipating Healy's idea, the latter elaborating the Pawn mate. Perhaps you will agree with me that Mr. Meyer has treated the two ideas most skilfully." [We do. Of the two, we consider this the finer problem.—Mephisto.]

SOLUTION.

Problem 134, by F. Healey, p. 374.

1. R to R sq.	B to K sq.
2. Q to Kt sq.	B to Kt4
3. Q to Kt sq. mate	
2.	if B × Kt
3. Q to Kt4 mate.	

Correct Solutions received:—No. 134: E. G. M. (rather vague), J. J. Cridlon (problem construction since then has advanced very much), A. E. Rayment, G. W. Middleton. No. 135: W., W. Furnival, Littlehampton, R. Champs (solution incorrect).

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